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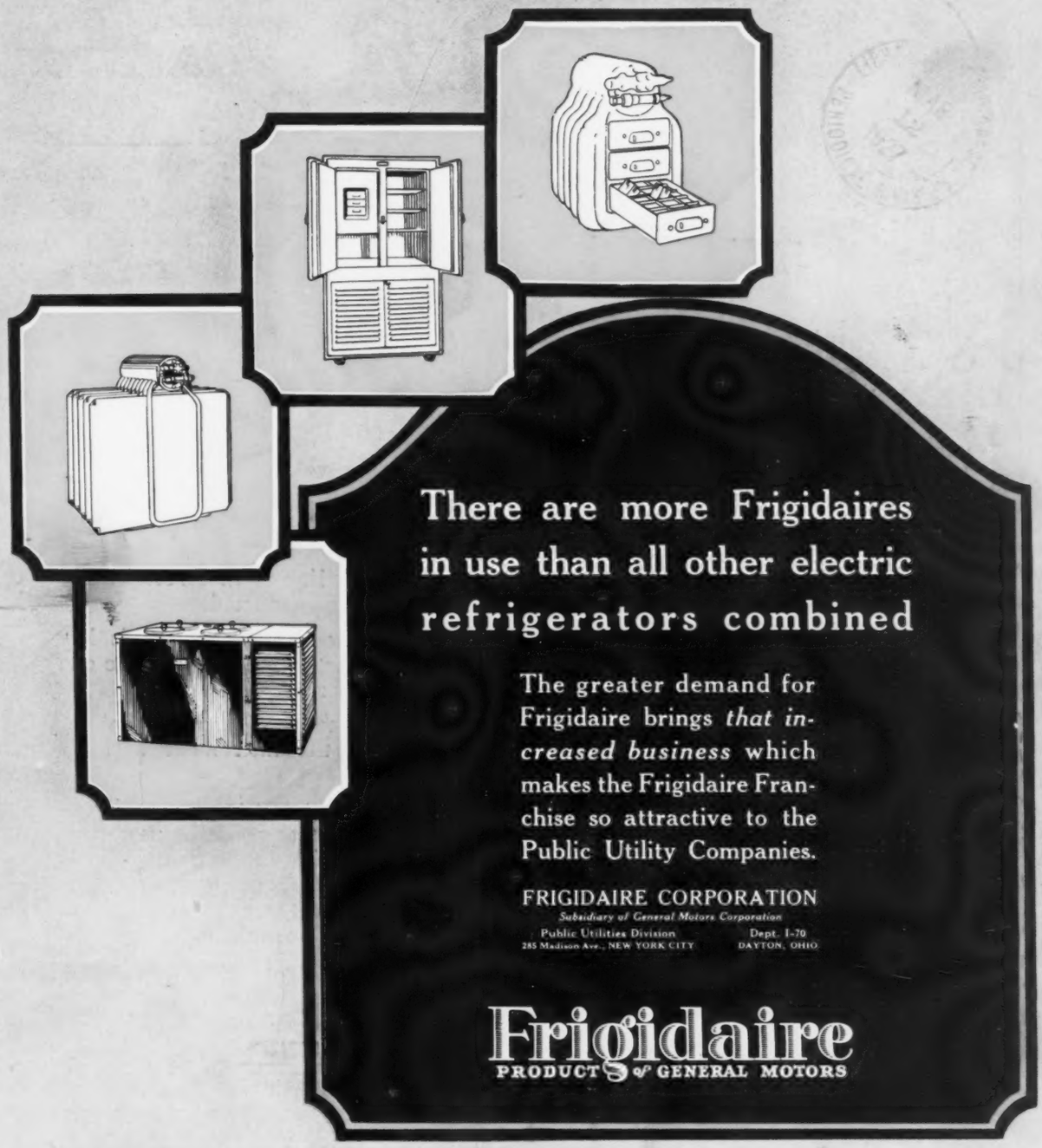
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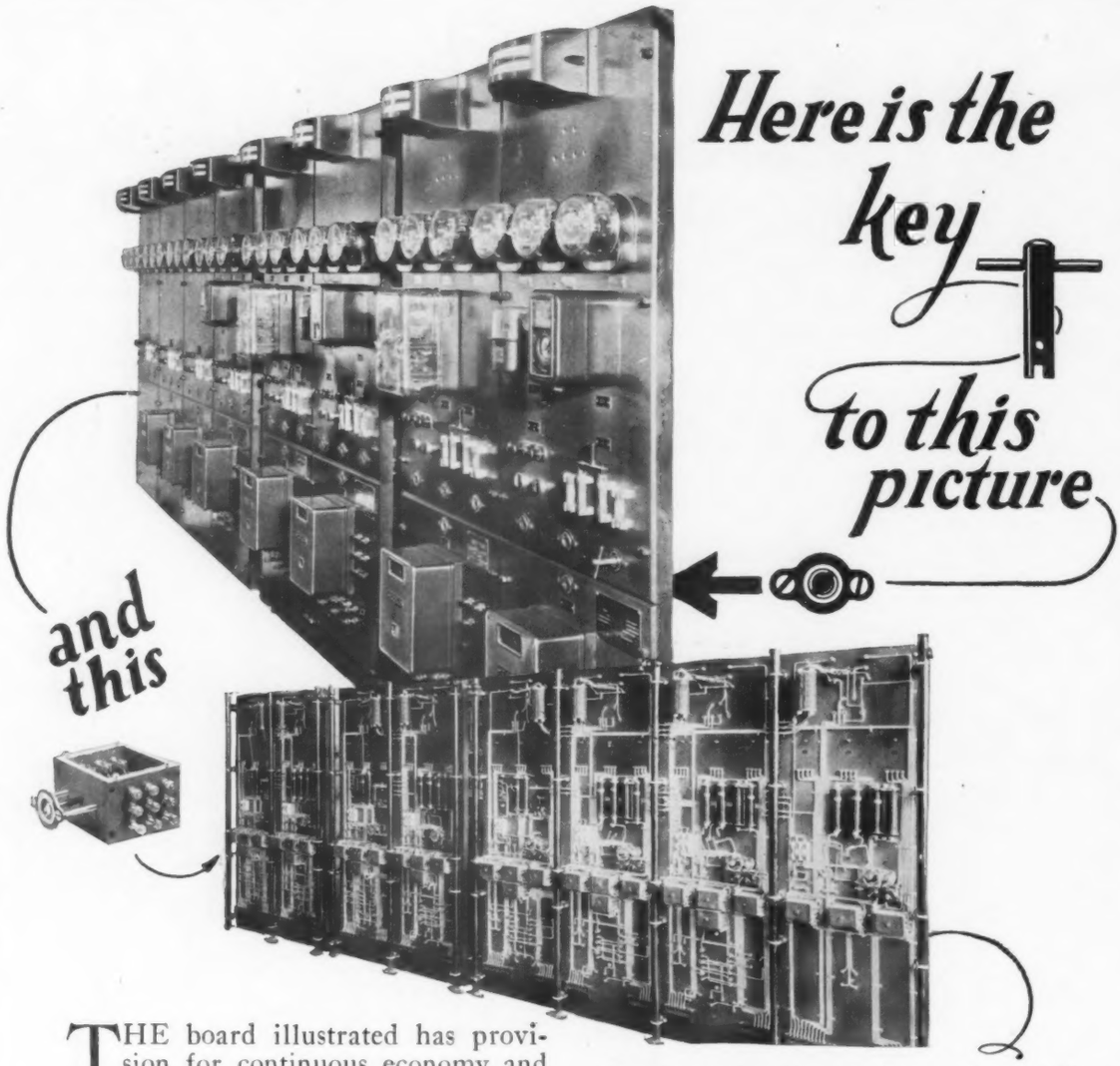

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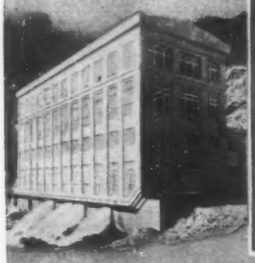

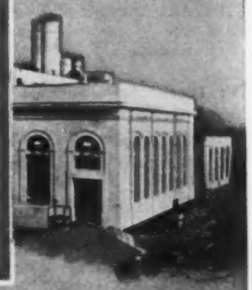

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C. T. HUTCHINSON, *Editorial Director* — A McGRAW-HILL PUBLICATION — G. C. TENNEY, *Managing Editor*

Volume 58 — San Francisco, March, 1927 — Number 3

Whether North or South "Let the Code Decide"

THIS is no idle slogan, "Let the Code Decide." This is more than a chant to be sung gloriously through the streets. It carries unlimited possibilities.

The presses of communities throughout the nation are busy turning out codes for individual communities, every one different. As if these were not enough to confuse the average intellect, there must follow interpretations by the score and rules to cover loopholes left in the original document. Each two-year period or more sees such a mass of changed rules that a plunge is taken into the accumulated volume and a new code emerges to follow the same rocky road.

The result is always the same. Confusion follows complication. While the electrical contractor or electrical inspector is busy with the actual work of doing wiring and inspecting it there is not enough time left in a day in which to accumulate knowledge of all the latest rulings and changes. And as between two communities whose borders touch, the rulings have been known to vary to such an extent that a journeyman electrician working in one community is at a loss how to install a job a short distance away from the first.

Just now the National Electrical Code is under revision. There is focused upon it the attention of the entire industry. Those entrusted with the task of revision are men of sterling qualifications. Their suggested revisions bear the mark of sober judgment and ripe experience. At no time in the past has the purpose of the code been so clearly defined. Its purpose is to provide a document definite in its rulings and comprehensive in its scope so that the dream, one code for all cities with a minimum of additional local restrictions, may become a reality.

But to let the code be perfect in every detail is of itself not enough. The code is merely a guide to adequate standards. Police powers are not granted to it. These must come from individual communities. Neither is the code assured of unanimous acceptance, and that is of more serious consequence than at first appears.

Westerners, however, are experienced in co-operation. Western associations have cemented together all branches of the industry in such a way as to be beneficial to all and detrimental to none. Once again Western co-operation is making itself felt for the good of both the entire industry and the public at large. At a recent annual meeting of the Northwest Association of Electrical Inspectors in Portland, the subject of code standardization was the most live topic in discussion. That association is ready to take a forward step toward a unified code adequate for all requirements.

This month the California Association of Electrical Inspectors will hold its annual meeting in Oakland, March 24-26. At that gathering the same subject probably will be the chief topic, and no doubt steps will be taken toward an acceptance of the National Code in its revised form as well as recommendations for a uniform ordinance for small communities not now having electrical codes or ordinances.

At least it is the desire of the leaders in this phase of electrical activity to simplify requirements and to work together toward uniformity. Their inspiration is more than a mere slogan. To them there is more than just an easy gesture in the significant words, "Let the Code Decide."

Executives Should Know Their Commercial Problems

"IT IS too bad there are not more company executives here." This comment was freely passed around amongst those attending the midwinter general meeting of the Commercial Section of the Northwest Electric Light and Power Association in Portland last month. It was a topic of informal conversation in more than one group forming for lunch or recreation after the sessions, and was expressed once from the platform during the formal deliberations. This practically universal desire for the presence of their chiefs was a perfectly normal one and probably had its foundation in the thought of three good results that might have been expected if the chiefs had been there. In the first place the executives could have brought inspiration to the meeting; secondly, they would themselves have been inspired; and, thirdly, they would have received a first hand knowledge of the commercial problems confronting their companies.

Probably being busy and having faith in their subordinates, the executives assumed that the problems would receive proper attention and that they could rely on their representatives for adequate reports as to what transpired at the meeting. This method of keeping in touch is no doubt fairly successful, but it is true that no one or two men from whom they might ask reports would draw exactly the same significance from the deliberations that the executives themselves would have drawn. Certainly the executives that did not attend are the poorer by a certain number of ideas and impressions that they would have absorbed had they been there and that they could not get in any other way.

Recently the plea has been broadcast throughout the industry to give the commercial department a more prominent place in central station operations. This is based on the sound theory that the power business is just as much a commercial enterprise as any other business; that if the enterprise is to be successful the product must be sold faster than is possible over the counter; and that responsibility for selling the product devolves on the commercial department. If we will admit that any commercial department can be made more effective than it now is, we will agree that one way to effect improvement is to take counsel from other successful operators. Hence a meeting like the one

mentioned, at which problems can be discussed as an aid toward their solution, where successful methods are expounded, and where new fields for exploitation are revealed, is extremely valuable to all member companies, since each can learn something from the others. Here commercial thinking is directed by interchange of ideas into profitable channels; here are developed theories on which successful policies can be formulated. Truly the executives might bring something to and take much from such meetings, and it is to be regretted that more of them were not present.

Importance of Water-Heater Survey Cannot Be Over-Emphasized

THOSE who have felt that the development of water-heating load has been retarded on account of lack of information as to its characteristics will receive a certain amount of satisfaction from the announcement that work on the water-heating survey in California is to be undertaken immediately. Since the publication of the report of the electric range survey conducted in the Pacific Northwest, the importance of a similar study with respect to electric water-heating has become more and more pronounced.

Experience in the Western states, where greater strides have been made in the sale of electric ranges than in any other section of the country, indicates that range and water-heater sales must go hand in hand. There has been no uniformity of opinion, however, regarding the type of water-heater service to be sold. In some sections it has been the practice to sell low-wattage water heaters operating on a flat rate. In others water heaters ranging in capacity from 3 to 5 kw. have been sold on metered rates. Little or nothing is known of the load characteristics of either.

The necessity for definite information can be demonstrated by repeating some of the discussion brought out at a meeting of the N.E.L.A. water heating committee held in San Francisco during the past month. One commercial manager reported that his company was serving 9,000 water heaters of low wattage that used 40,000,000 kw-hr. per year and in return was receiving a revenue of only 5 mills per kw-hr. Another is serving 1-kw. heaters on a metered rate of one cent per kw-hr. that use 400 kw-hr. per month, while a third serves 3-kw. heaters at the same rate and with the same energy consumption. In California satisfactory water-heating service from the standpoint of the customer is being provided with heaters of 5-kw. capacity at rates ranging from 1½ to 2 cents per kw-hr. Obviously, from the standpoint of the central station, some one type of service is more desirable than the others. Before a decision can be reached definite information must be secured on such questions as average demand, diversity, and load factor.

It is the purpose of the water-heater survey to secure information on water-heating load characteristics so that it will be possible to determine the type of service most desirable both from the standpoint of the central station and the consumer and at the same time permit the establishment of a proper rate for this service. Obviously, this survey is important to central station and water-heater manufacturers alike. It is generally conceded that it is fully as important as the electric-range survey. Before it can be undertaken, however, it must receive the support of those executives who will say "aye" or "nay" to the appropriation required. The job of selling the survey to those executives is one for every commercial man to undertake.

The Combined Fuel Bill as a Mental Hazard

COST of operation is the largest single item of sales resistance in the way of greater electric cooking and heating sales. If the salesman is not adversely influenced by this seeming obstacle, the prospect is. It forms the basis of practically every argument against the electric range or air heater advanced by a prospect.

Merely striving to sell electric ranges, for instance, on superior qualities of performance will not solve the difficulty. It is true that a large number of housewives will buy electric ranges because they offer more cleanly kitchens and kitchen equipment. Yet to no little percentage of even such fortunately placed women the matter of operating cost will come in for serious consideration.

To those who have compared operating costs of complete electrical heating installations, including not only the range and water heater but air heater as well, the cost of operation for over-all results is not at all out of proportion to costs of other means of heating and cooking. Especially is this so in some sections of the West in which fuel costs are unusually high. The chief difficulty seems to be to get prospects to consider the fuel and light bill as a whole. A person used to paying a certain sum for lighting, a certain sum for cooking fuel and another for house heating, on seeing a bill for electricity which covers all of these items together, by comparison with former lighting bills alone, is apt to get the impression that electric heating and cooking is quite costly.

It will take education to bring about a viewpoint which accepts the fuel bill as a whole. That education must be accomplished by patient and painstaking effort, both in advertising and in selling. More than anything else it will require the faith of electrical men themselves that electric heat is not expensive when all factors are taken into consideration.

Opportunity Masked Is Still Opportunity

SPEAKING of time-honored adages, consider the one about opportunity knocking once at everyone's door. The old saw is all right as far as it goes, if one only had the discernment to recognize opportunity when it does knock. Here is a story, a real one, about this interesting topic that is worthy of preservation.

A young woman, employed by a business house not unknown in the San Francisco Bay region, exceeded the speed limit when passing through one of California's delightful towns down the Peninsula, and, thanks to the vigilance of our guardians of the traffic peace, was duly apprehended for her breach of the laws.

On blue Monday, chastened and contrite, fearing that her job would be jeopardized by asking for time off on that busy morning, she used her native wit and ingenuity in the composition of a letter to those in authority, enclosing the amount of her fine. This letter must have been a masterpiece of special pleading, because on its receipt it was passed from hand to hand, up, and then farther up, until it came to the attention of the head of one of San Francisco's leading merchants. He was so taken with its delightful style and whimsical humor that he saw in the writer an advertising manager for his business.

An interview followed. Viewed in person, the writer measured up to the promise indicated by the letter, but she, rather than confine her talents to a single outlet, was shrewd enough to grasp Old Man Opportunity by

both hands, annex the advertising account of the merchant, and then make a dicker with an advertising agency on the strength of it. Through this deal she was retained by the agency at a very respectable salary indeed, plus a commission on the merchant's account.

So, one never can tell just when opportunity will knock, or in what guise. This little sermon is not to be construed as advocating that the speed laws of the State of California should be broken, but rather that one should put one's best foot foremost always, no matter how trivial the occasion may seem at the time. Everything is worth doing well. An angel unaware may wear the habiliments of a justice of the peace, even a triffic officer.

Progress Reported by Northwest Electrical Inspectors' Association

A HEALTHY growth in membership and a substantial measure of accomplishment in its first year of existence was noted at the January convention of the Northwest Association of Electrical Inspectors reported in the last issue. Somewhat over a year ago the JOURNAL OF ELECTRICITY editorially commended the organization to the rest of the industry in the territory, stating that it would be able to sponsor certain constructive movements that no other organization was in a position to indorse.

Of immediate importance to the industry in the Northwest is the influence the association is putting behind legislation of benefit to the industry. A new electrical code in Washington and a bill to concentrate under one department in Oregon all state electrical inspection are examples of the type of legislation the association is fostering. Code standardization is yet another task undertaken by the organization. Exposition is given in this issue to some of the functions and accomplishments of this association as a reminder of the good to be expected, in the hope that the support of the other branches of the industry will continue to flow to it in the volume necessary to make its work most effective.

A Lesson in Arithmetic for Politicians and Voters

WHILE the American public has been showing a vital interest in the debts of European nations, particularly those that were the heaviest borrowers during the late World War, it is paying little or no attention to the rapidly mounting total of indebtedness of its own governmental subdivisions. The National Industrial Conference Board recently issued a report on local and state indebtedness that should, if given wide publicity, startle public officials and voters alike into a more rational attitude.

This report shows that at the beginning of 1926 the total net indebtedness of state and local governmental agencies was $11,650,000,000 as compared with $8,697,000,000 in 1922 and $3,822,999,000 in 1913; or net increases of 205 per cent for the period from 1913 to 1922 and 34 per cent from 1922 to 1926. These figures do not take into consideration federal indebtedness, the increases in which were largely accounted for by the war.

Approximately 20 per cent of the aggregate of new bonds since 1913 was issued by state governments, 15 per cent by counties and the remainder by municipalities and other local governmental agencies. In 1923 alone total expenditures for state and local government were equivalent to $58.71 for every man, woman and child in the country. Interest charges on new bonds issued since 1913 by states, counties and municipalities now amount to $322,999,999 annually.

Further examination of the National Industrial Conference Board report furnishes enlightenment in the wide range of expenditures now grouped under the head of "cost of government." Government, *per se*, is not so expensive as the modern frills and furbelows, largely made up of ventures into experimental fields of municipal ownership. If the report does nothing more, it offers convincing proof of the fact that government must be confined to its proper functions rather than he allowed to experiment with business enterprises, if the reduction in taxation that is so vitally needed is to be brought about.

No Slide Rule Will Solve the Human Equation

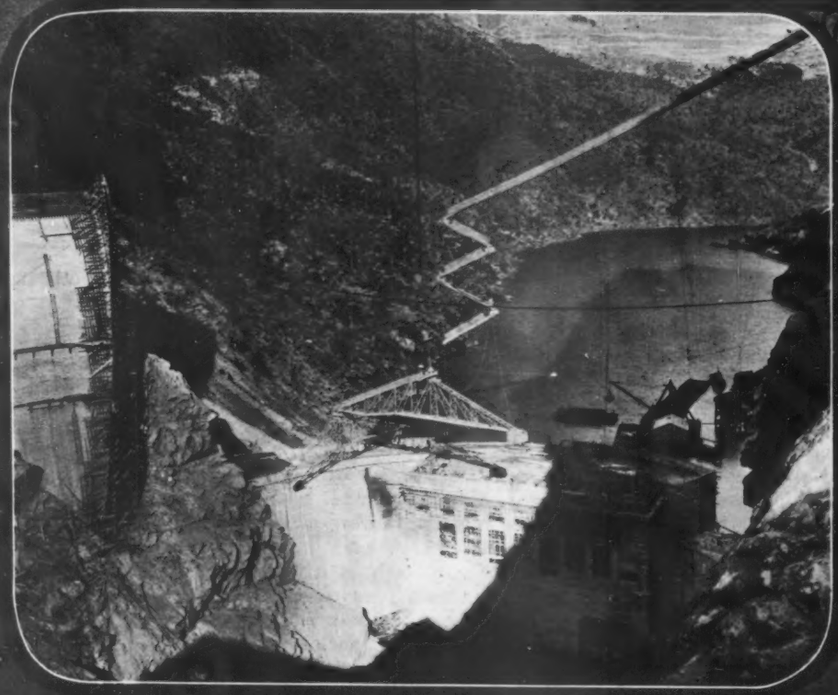
PROBABLY one of the most precarious pastimes indulged in by the industrial executive of today is picking men. With what might be called characteristic American enterprise, scientists, analysts and psychiatrists have attempted to set up all sorts and descriptions of formulas for the purpose of solving the human equation. There is the so-called "intelligence" test, made famous during the war, by which it was learnedly determined that some unbelievable percentage of our American youth consisted of morons, half-wits, having the brain development of a normal child of twelve. And so the case was tested by the performance of these alleged mental twelve-year-olds on the battlefields of France and Flanders in a manner still remembered in Germany.

Personnel managers have a stereotyped set of questions to propound to applicants for jobs, another attempt to set up a formula. In the majority of cases a personal interview is denied, thus preventing a chance to "size up" the applicant as to his personality, the most important factor of all. Age, education, parentage, and experience—this seems to be about the best we can do. We turn down the man past fifty—too old. We prefer the college man, although it is not impossible that all he got out of his Alma Mater was a Greek-letter fraternity pin and a set of "high-hat" notions. We ask how long he was with his last employer, when often a short time with some employers is to the credit of the man's intelligence.

Trial and error—that seems to be the only answer. We must hire and fire; we could do less of both if we could forget the formulas and nostrums and study humanity. The employer, or boss, lets himself become too much absorbed by columns of figures and not enough in studying his men. The late Andrew Carnegie ascribed his success to the ability to surround himself with men better than himself. He was a real personnel manager. Any boss might well let the study of the statistics of his business become of secondary importance and put in more time in contact with his men, and this cannot be done by maintaining a position of isolation from the rank and file. A man may easily be converted from failure to success by a little human sympathy and help. Know your men personally, Mr. Boss. Seek their confidence. Listen to their troubles. Help them with their problems, business, social and domestic. That is the way to build morale, to form a real organization, and will do away with the necessity for trying to create loyalty by broadcasting high-sounding platitudes from the top of a mountain..

Power and Irrigation Development in Arizona

WATER resources of the Salt River in Arizona are being developed to provide power and irrigation to the lands of the Salt River Valley Water Users' Association. The upper picture shows the recently completed Mormon Flats dam and power house providing 90,000 acre-ft. of storage and 14,000 kw. of power. The lower picture shows construction work on the Horse Mesa project where a 300-ft. dam will provide 300,000 acre-ft. of storage. The power house will develop 34,000 kw. with two units. The Mormon Flats plant was completed in May, 1926, and the Horse Mesa project will be completed in time to store the spring run-off.



The Cushman Hydroelectric Development

A Description of the Hydraulic Features

By J. V. Gongwer
Structural Engineer, Cushman Power Project, City of Tacoma, Tacoma, Wash.

A STORAGE and regulating reservoir of 440,000-acre-ft. capacity forms the heart of the Cushman power project of the City of Tacoma, Wash. This development is located on the North Fork of the Skokomish River in the southeastern portion of the Olympic Peninsula 44 miles north-westerly from Tacoma. Ultimately it is expected to include two plants with a total capacity of 140,000 hp. in five prime movers. The first unit of the project as a whole includes the dam and storage reservoir, penstocks and control works, power house, switching station, transmission lines and terminal substation in Tacoma, all of which was initially operated in March, 1926. The large water storage provided by the dam, the short tunnel required to connect the storage basin with the power house and the general simplicity of the plan are the outstanding features of the hydraulic end of the development.

NATURE sometimes seems to facilitate man's harnessing of her energy and at other times seems to fling a challenge to any attempt at interference. Representations of both of these apparent moods are evident at Lake Cushman. Natural assistance to the justification of this project was present in the form of a 440,000-acre-ft. storage basin while the challenge was presented in the form of variations in stream flow ranging from 85 to 17,000 sec.-ft. In this article Mr. Gongwer describes the dam and its adjuncts, while in the article immediately following Mr. Darland covers the power house and transmission line.

A watershed of 90 sq. miles ranging from 500 to 6,500 ft. above sea level and located in one of the heaviest rainfall sections of the United States feeds the river serving the Cushman plant. Records of the United States Geological Survey taken over a period of 13 years indicate an overall average flow of 810 sec.-ft. This flow is equivalent to an annual average rainfall over the entire basin of 122 in. assuming 100 per cent runoff. The annual rainfall at the power site during the construction period was 95 in. These figures lend support to the belief that at the summit of the Olympic Mountains the yearly rainfall is nearly 200 in. Heaviest runoff occurs between the months of September and April, dropping during the winter months due to the accumulation of snow in the mountains. Late summer flow drops as low as 85 sec.-ft. while the maximum recorded flood is 17,000 sec.-ft. and the normal annual peak flow ranges from 6,000 to 8,000 sec.-ft. Floods of these magnitudes rarely last more than a week but occur many times during the rainfall season.

The drainage area lies largely within the Olympic National Forest and is heavily wooded with the exception of the higher elevations, and excepting the storage basin where it was necessary to remove 350,000,000 ft. of merchantable timber between El. 500 and El. 800. This timber was removed by private logging companies for commercial purposes. From timber line to summit the mountains are rocky and precipitous and snow covered until late summer. Perpetual snow is found in the upper watershed.

Total storage in the basin below El. 735 is 440,000 acre-ft., 360,000 of which is available for use at the present power house. This 360,000 acre ft. of storage is in the upper 120 ft. of the basin and represents 60,000,000 kw-hr. of energy at normal operating effciencies and is sufficient to care for both seasonal and annual fluctoations in the river flow. Without it the power development would be unwarranted.

The remainder of the storage would afford only inefficient operation of the present plant, but will be available for use in a future plant to be built at sea level utilizing the hydraulic head between the tail water of the present plant and tide water on Hood Canal. A draw-down in excess of 120 ft. is not expected, however, except in rare cases.

The basin created by the dam is a long L-shaped area approximately 5,000 acres in extent, 8½ miles long and about a mile wide terminating at an excellent natural dam site in a gorge having 200-ft. andesite basalt walls. Downstream from the dam site a distance of 700 ft. there is a bulge in the gorge that provided a convenient natural location for the power house structure. Another natural aid to construction was an immense bed of sand and gravel deposited in the river immediately above the gorge as its flood flow was restricted by the canyon. This deposit furnished aggregate for all concrete used in the project.

Dam and Spillway

Careful study and investigation of various types of dams led to the selection of the Jorgensen constant-angle arch dam as the most economical and best adapted to the site in question. The dam is 279 ft. high, 1,200 ft. long including gravity-type abutting wings, 53 ft. in maximum thickness at the base and 8 ft. thick at the top. The entire structure contains 90,000 cu. yd. of concrete.

The arch portion of the dam has an upstream base radius of 118 ft., a crest radius of 200 ft. and upstream crest length of 412 ft. The south gravity abutment wing is 278 ft. long and the north gravity abutment wing 130 ft. long. Continuing from the end of the north gravity section is a core wall 380 ft. long extending to bedrock and supported on both sides by

Looking up the Cushman storage basin toward Mounts Ellinor and Washington from a point near Cushman dam.

earth fill. The top of the dam is finished with parapet walls to form an 8-ft. driveway. The only reinforcing steel used in the dam is in the roadway bed and parapet walls.

Bedrock was found at El. 474, about 25 ft. below the original river bed. The rock was found to be very smooth and had to be roughened to provide a bond for the concrete. The usual channel for keying the dam to bedrock was excavated near the upstream edge of the structure and continued up the side walls of the canyon to secure the dam in place more firmly and also to increase the leakage path around the edge of the structure.

The concreting plant used for the construction of the dam was located on the north rim of the canyon on the upstream side. A 2-yd. mixer was used and concrete was spouted directly into the dam during the initial stages of the work and later elevated through a tower for spouting to the upper portions. Sand and gravel from the river-bed deposit previously mentioned were washed and graded before hoisting to the measuring bins located immediately above the mixer. Cement was stored in a warehouse at an elevation above the concreting plant permitting it to be hauled by gravity from the warehouse to the measuring bins.

A 62-in. Pelton-Johnson type control valve coupled with a Pelton 90-in. butterfly valve are built into the dam at El. 520, a few feet above the original river bed. The two valves are placed in series because the enormous quantity of water stored above them makes necessary the utmost dependability. Further, this arrangement permits repairs to the Johnson valve without draining the basin.

The control valve has a discharge capacity of 2,000 sec.-ft. and is to be used to pass water for a future lower power development at times when the Cushman No. 1 plant is not operating at normal capacity. The valves now are used to pass excess water from the basin pending the completion of the spillway.

Maximum lake elevation was fixed largely by the nature of a saddle in the rim of the basin a quarter of a mile south of the dam where rock and cemented gravels known to be impervious to water dropped to El. 683. This saddle is 500 ft. long and in it the spillway now is being built. Spilled water will find its way to the Skokomish River canyon at a point one-half mile below the power house.

Construction of the spillway was delayed purposely in order to ascertain definitely the degree of water percolation from the lake through the earth materials in that portion of the basin's rim. Test pits sunk into the saddle indicated that these materials could not be depended upon to hold water. High water reaching El. 708 since closing the dam and conversion tunnel confirmed these tests and proved the advisability of constructing a core wall across the spillway saddle extending down to rock or to cemented gravel. This core wall is 18 in. thick and is being built to El. 735 where the crest will be finished in the form of a spillway. A concrete apron will extend back a distance sufficient to protect the core wall and the rim of the basin.

Intake and Tunnels

Inasmuch as calculations showed that only the upper 120 ft. of storage is needed for normal stream regulation the main intake is located at El. 600. This location provides ample storage capacity for normal operation and results in less pressure upon the gates. The main intake is 25x50 ft. in section, built of reinforced concrete and protected by a trash rack of ½x4-in. steel bars spaced 3 in. on centers. This rack is placed on an incline to facilitate removal of debris and is fitted with a power-operated trash rake with haulback. Two 7 x 12-ft. Philips and Davies caterpillar-type gates operate through a vertical well at the head of the tunnel and just back of the intake. Operating gear for the gates and trash rake is installed on a reinforced concrete tower immediately above the gate-well and trash rack and is accessible from the top of the dam by means of a short bridge. The tunnel vent and the operating rod for the by-pass valve are carried up this tower to a point above high water. The by-pass valve is used to fill the tunnel and thus equalize the pressure before opening the main gates.

Although the economical tunnel diameter for average flow figured out to be 13.5 ft. the final design called for a 17-ft. diameter. This increased size reduces the velocity and consequently reduces any pressure rise that may occur incident to a sudden load rejection by the turbines. The tunnel is circular in section and lined with not less than one foot of concrete placed with timber forms. Reinforcing was used only where the weight of overburden might possibly be questioned. Lateral branches leading to the penstocks are 12 ft. in finished diameter. The portions of the tunnel built for diversion and drainage only are 10 ft. in diameter and unlined. The 6-ft. butterfly valve closing off the upper end of the diversion tunnel is accessible through a tunnel piercing the rock from a point in the canyon below the dam. The downstream end of the diversion tunnel is plugged with a concrete block into which is fitted a 6-ft. steel pipe and which in turn is reduced through a steel casting to a 24-in.

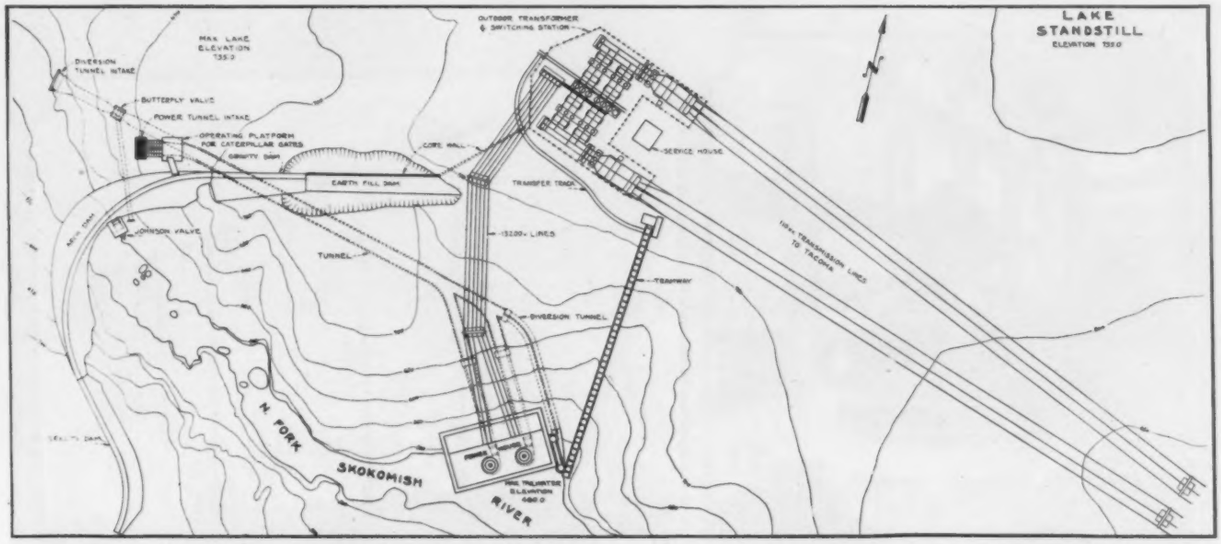


Fig. 1. Plot plan of Cushman No. 1 development. Spillway is located several hundred yards south of southern gravity section of the main dam

circular section and connected to a gate valve for drainage purposes. Timbering was unnecessary and excavation was completed with but little overbreak. Concrete in the upper sector of the arch was placed by air and voids were filled subsequently through grout pipes.

Maximum tunnel velocity is but 9 ft. per sec. with each water wheel using its required 1,000 sec.-ft. This low velocity and the short length of conduit between intake and water wheels obviated the use of relief valves and surge chamber.

Diversion of the river for operations at both the dam and power house was accomplished by means of an upstream cofferdam and a flume from that point discharging below the power house a distance sufficient to prevent backwater at the site of the power house excavation. The cofferdam consisted of two double rows of Wakefield sheet piling spaced 12 ft. apart, sealed with clay and filled with earth and rock. The structure was very tight and served throughout its necessary existence without repairs, even withstanding floods that topped its crest by several feet. The flume was a timber structure 10 x 20 ft. in section with a capacity of 2,000 sec.-ft. Floods often necessitated the use of the tunnel in addition to the flume in order to protect the latter from damage.

During the late summer and early fall of 1923 the frequent necessity of diverting through the tunnel into the power house excavation resulted in delaying the starting of the power house structure until the spring of 1924. Concentrated effort later on, however, compensated for the delay and the power house was ready for operation as soon as sufficient water had been accumulated back of the dam to provide adequate operating head. Final diversion was completed through the tunnel in November, 1925, after the opening left in the dam for the diversion flume had been closed.

Transportation problems were simplified by the presence of a logging railroad and a good road both within a half-mile of the site. Both of these were made available to the project with but little initial expenditure. Shipments of machinery and equipment were

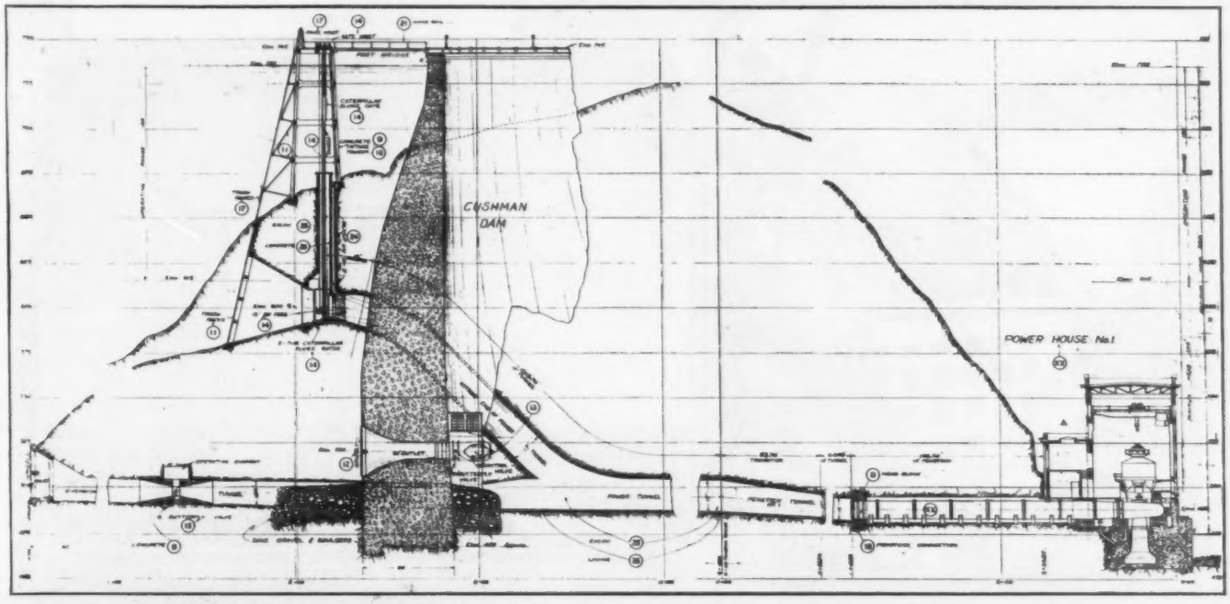
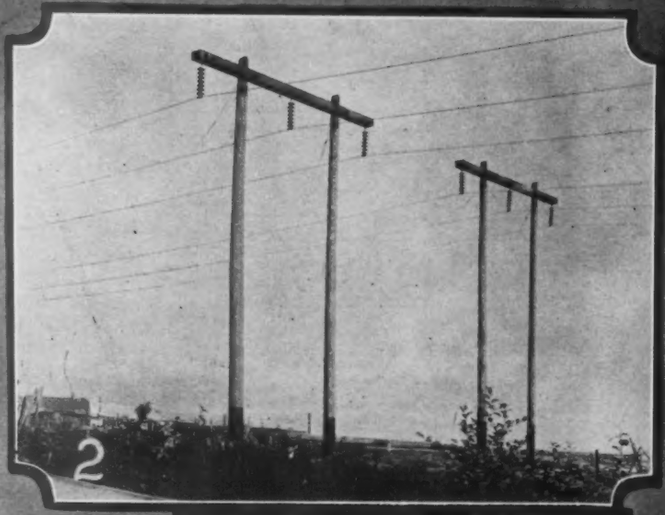
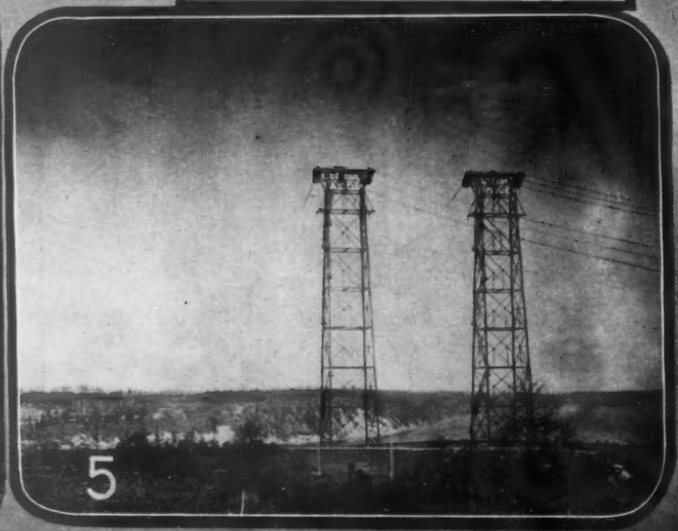


Fig. 2. Typical section through Cushman dam and power house showing relative location of all important equipment.





Lake Cushman Project

THE interior of the Cushman plant showing the two 20,000-kva. Allis-Chalmers generating units is shown in (1). (2) shows standard tower construction on the 2-circuit, 110-kv. transmission line from the plant to Tacoma. The switchyard and transformers located on the ridge above the power house are shown in (3). Low tension leads from the generators are brought up the hill to this point. (4) shows the relative location of the power house and dam. Had the topography permitted the power house would have been integral with the dam but natural conditions did not permit this arrangement. Towers supporting the Narrows crossing of the transmission line are shown in (5). This span is 6,241½ ft. long, the longest in the world.

consigned in original cars direct to the power site, cars being transferred by barge to the logging road terminal on Hood canal. Water shipments were transferred to cars at Tacoma or Seattle and handled in like manner. Cement was delivered on barges at Hoodsport from a nearby mill and hauled by trucks to the project.

Hydraulic development necessary for the utilization of the head between the tailrace of No. 1 power house at El. 480 and Hood canal at sea level will require only the construction of a much smaller dam, about 12,000 ft. of tunnel and penstock, and the power house itself. This second unit will make available an additional 90,000 hp.

The Cushman Hydroelectric Development

A Description of the Electrical Features

By A. F. Darland

Electrical Engineer and Superintendent of Electrical Construction, Cushman Power Project, City of Tacoma, Tacoma, Wash.

POWER supply for the City of Tacoma has been augmented in the amount of 40,000 kva. by the completion of the Cushman No. 1 hydroelectric plant, transmission system and receiving substation. This first complete unit of the development cost $5,250,000 and makes available in the southern Puget Sound area the first large block of power from the Olympic peninsula. Features pertaining to the hydraulic development are covered in the foregoing article and the electrical installation will be covered in the following discussion.

Building and Arrangement

Except for the extreme narrowness of the river gorge at the dam site the power house would have been located immediately at the base of the dam. As it is, however, the building is about 700 ft. downstream from the dam on a bench partially excavated from solid rock with the main operating floor at El. 494.5. The building is a reinforced concrete structure 134½ ft. long, 74 ft. wide and 83½ ft. high from the basement floor to the parapet of the portion housing the generator room. The 2-story annex is 36 ft. high above the main floor. As much window area as possible was provided in the building design in order to secure adequate natural lighting during the cloudy and rainy weather prevailing generally in the vicinity of the power house throughout six months of the year.

Hydraulic turbines are placed at the main floor level, with their governor stands, oil pump and air compressor located alongside. The generators are 10 ft. above the main floor, supported by heavy castings extending from the speed rings of the turbines. A spare motor-driven exciter and the exciter switchboard are located on a mezzanine floor between the two generators. A 44-ft. Whiting crane with both 100-ton and 15-ton hooks facilitates the handling of power house equipment. Lubricating oil storage tanks, oil purification plant, auxiliary air compressor, fire pump and auxiliary transformer cooling water supply pump are located in the basement of the building. Machine foundations in the basement are open on each side to the draft tube permitting removal of the runner by telescoping a steel section of the draft tube. Three hatches are provided in the main floor to facilitate handling the heavy parts by the crane and also to permit the lowering of transformers to the basement floor level for repairs.

The 13.2-kv. generator and station service switches, and the 2.3-kv. station service transformers and switches are on the main floor of the 3-story portion of the building known as the annex. Switches and transformers are installed in individual compartments to insure localizing of possible electrical faults and troubles. A store room for heavy materials and parts and equipment for a salt-velocity system of measuring water flow through each penstock also are on the main floor of the annex. The control room, storage battery room, carrier-current telephone equipment room, office, machine shop and the general store room are on the second floor of the annex. Lightning and surge arresters protecting the generator leads are located on the roof of the annex as also is the protective equipment for the carrier-current telephone apparatus.

Each of the two Allis-Chalmers vertical units has a rating of 25,000 hp. at 230-ft. head and 200 r.p.m.

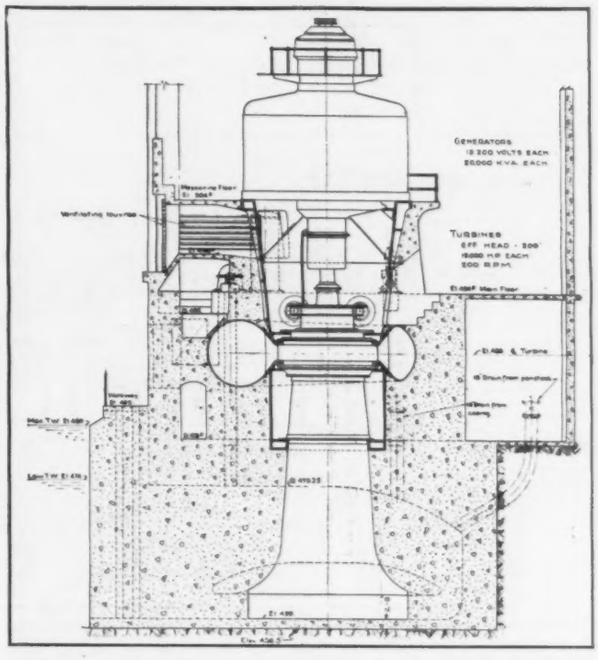


Fig. 1. Section through generator unit showing method of mechanical support.

on the turbines and 20,000 kva. at 0.9 power factor, 60 cycles, 12-13.2 kv. Water-wheel casings are of riveted plate steel and were tested in place, before concreting, at a hydrostatic pressure of 187 lb. Each casing is riveted to a heavy cast steel speed ring which in turn serves as a foundation for the generator. Each speed ring is supported on a deep cast iron barrel embedded in the concrete foundations of the unit and a second cast iron barrel is secured to the upper side of the speed ring and extends up to and supports the lower bearing bridge and stator of the generator. Thus, in effect, each water wheel and generator constitutes a unit and the accuracy of assembly is assured by machined surfaces of the supporting barrels. The supporting barrel of the generator is encased in concrete to secure rigidity and also to tie the generator foundation to the building at the base of the machine. The rotating element of the complete unit weighs 100 tons and is supported on a Kingsbury thrust bearing. Three guide bearings are provided, two on the generator and one on the turbine and are oiled by viscosity pumps. Auxiliary motor-driven oil pumps are provided for emergency use.

Utilization of only one runner per machine for a range in operating head of 120 ft. out of a maximum operating head of 255 ft. required a compromise runner design for an average head. This head was fixed at 230 ft. and at that point the model runner tested at the Holyoke laboratories developed 93 per cent efficiency. Efficiency runs on the assembled machines have not been conducted as yet. It is contemplated ultimately to utilize two runners for each turbine, each runner to be used for a draw-down of 60 ft., thereby securing a better average turbine efficiency. Governors are Allis-Chalmers fly-ball type mounted directly on the shaft of the main unit with the operating stand located on the outside of the supporting barrel in view of the station operator. Each unit is supplied with a motor-driven oil pump and an auxiliary water-wheel-driven oil pump that comes into service automatically upon failure of the oil pressure that normally is supplied by the motor-driven pump.

Generator windings are mica insulated and designed to operate at full rated load within a temperature rise of 60 deg. C. The actual temperature rise is nearer 40 deg. C., based upon a 20,000-kva. load at 0.9 power factor and permits loading the generators to 22,000 kva. without excessive temperature rise. This latter load is possible when maximum head is available and with the turbines operating at full gate opening.

Direct-connected 180-kw., 250-volt exciters serve each generator. Exciters are constructed for voltage stability under all operating conditions requiring excitations above the residual voltage of the exciter without the use of generator rheostats. Operation of these exciters has been entirely satisfactory even during tests when deliberate attempts were made to disturb the equilibrium of the exciter voltage. A 150-kw. motor-driven, spare exciter is installed on a mezzanine floor between the two generating units and in addition to its use as an exciter it supplies d.c. power to the crane. The spare exciter also has stable voltage characteristics down to residual magnetism. Exciter and field switchboard panels are located on the mezzanine floor to secure the shortest feasible routing of field leads.

Each generator feeds through its own 13.2/110-kv. transformer bank to the 110-kv. bus. Each generator also feeds the double station service bus through individual 450-kva., 13.2/2.3-kv. transformer bank. All of the 13.2-kv. breakers are of the FH-203, truck-mounted cell-type and the 2.3-kv. breakers are FR-132, truck-mounted type. These latter are of low interrupting capacity, permitted by the low-capacity, high-reactance station service transformers. Feeder voltage regulators are used on the lighting circuits to correct for variations in generator voltage necessitated by transmission line regulation.

The spare exciter driving motor is supplied with

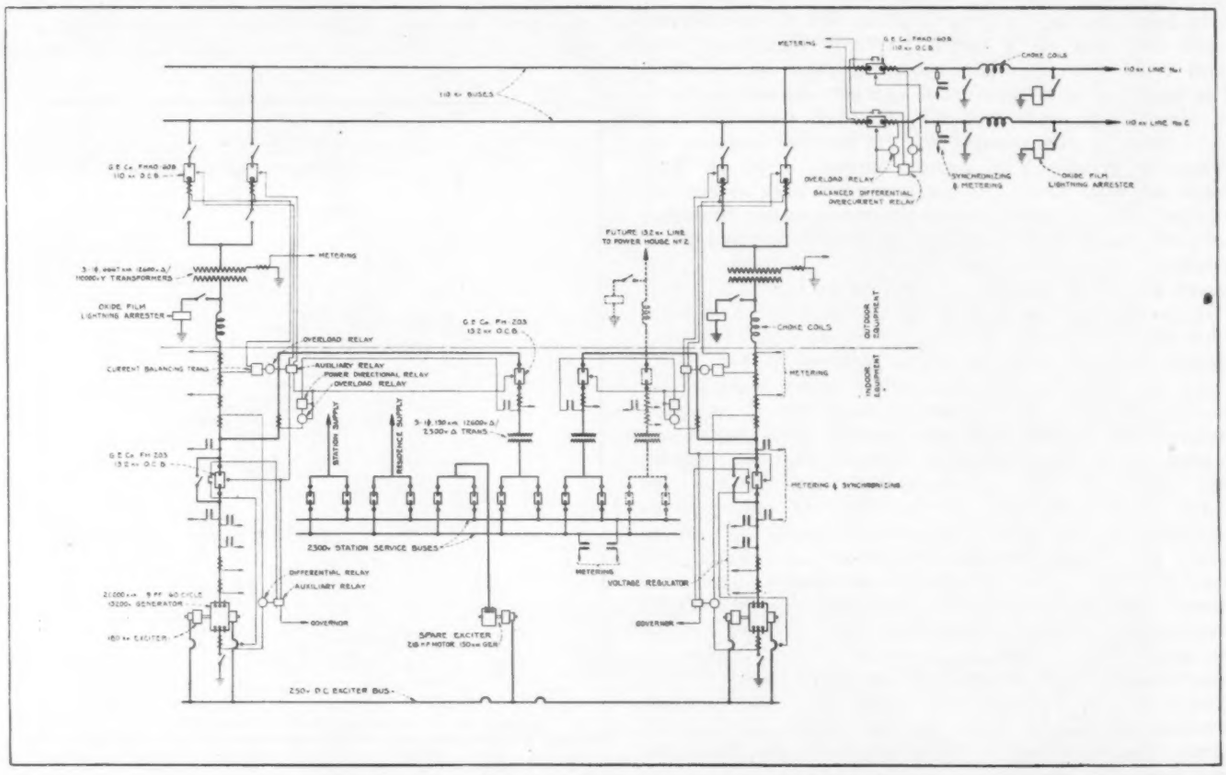


Fig. 2. Schematic wiring diagram of Cushman No. 1. plant.

3-phase 2.3-kv. power and starts at bus voltage. All other motor-driven auxiliaries are operated on 3-phase 440-volt circuits without the use of reduced voltage starting devices.

Control and Protection

Skylights add to the natural light facilities provided for the control room. The bench board and two flanking vertical switch boards form a U with the bench section parallel to the glass partition separating the control room from the generator room. All controls and control equipment, meters and relays for both the power house and the switching and transformer station are centralized on these boards. Instruments keep the operator advised as to the operating condition of all important equipment. In addition to the usual recording instruments Leeds and Northrup temperature recorders are used for the generators and transformers and remote-position indicators of the Selsyn type indicate directly on the switchboard the degree of gate opening and also the setting of the governor load limit. Separate generator-voltage regulators are supplied for each main exciter and also for the spare exciter. It is common operating practice to synchronize the incoming generator with the voltage regulator in service.

Differential relay protection on each generator opens the generator line and field breakers and shuts down the unit in the event of internal trouble. Reverse-power relays on the 13.2-kv. station service switches prevent cross flow of power through the station service bus due to different generator voltages resulting from unequal loading. Uneven machine voltages at different loads are due to the different reactive drops through the main transformer banks. The station service bus is not intended as a synchronizing bus and except at times of switching is connected to only one generator. Synchronizing ordinarily is accomplished at the generator circuit breaker, but either machine or the entire plant may be synchronized across the 110-kv. transmission line switches.

The main transformer banks also are protected by differential relays while the two outgoing transmission lines have balanced relay protection. The system is operated normally at 60 cycles, a Warren clock serving as a check on operating speed.

A 36-unit annunciator warns the operator of any automatic relay operation affecting load conditions and any abnormal condition in the generating units, such as hot bearings, low governor oil pressure or hot generator windings. Switchboards and metering equipment were supplied by the General Electric Company. All recording instruments are actuated by synchronous motors instead of by spring-wound clocks.

Fig. 3. Construction view taken in September, 1925, showing power house at base of cliff and switch yard at the top. It may be noted that concrete is being chuted down the cliff into the power house forms from a mixing plant near the top of the cliff.

Topography precluded the inclusion of the high-tension equipment on the power house site. Therefore the 13.2-kv. generator leads are carried some 600 ft. up to the transformer and switching station on

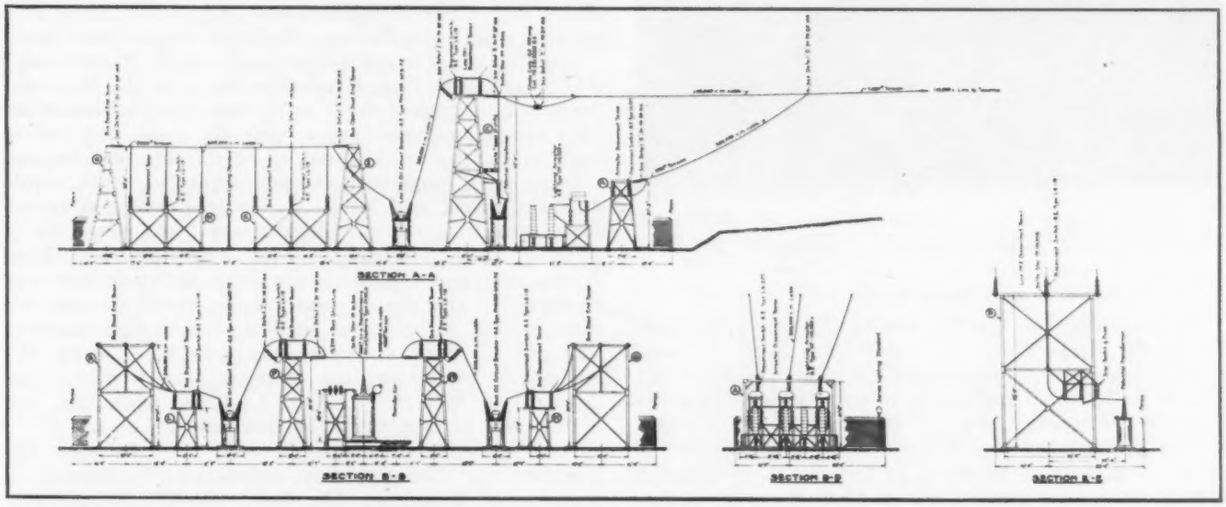


Fig. 4. Elevations of switch yard. Section A-A is a longitudinal section through one of the 110-kv. buses showing bus, line breaker, disconnecting switch, current transformer, and lightning arrester. Section B-B is a transverse section through the 110-kv. buses showing main transformer bank flanked by circuit breakers and buses. Section D-D is a transverse section through lightning arrester. Section E-E is a transverse section through a terminal tower.

top of the canyon walls at El. 760. Equipment of the switching station comprises two banks of three 6,667-kva. Allis-Chalmers transformers, with a seventh transformer as a spare; six 110-kv. G.E. circuit breakers rated at 1,000,000 kva. rupturing capacity, based upon two operating cycles at a 2-min. interval; two 110-kv. potential transformers, and two 110-kv. oxide film lightning arresters. A one-story 30 x 30-ft. concrete building houses the oil treating equipment, a small light and power bank, shop space and a small office. Transformers are connected delta-star with solidly grounded high-tension neutral.

A relatively large ground area was used for the switching and transformer station and the resultant layout is simple and rather unusual. The seven truck-mounted transformers are mounted in a row in the center of the yard. Down each side of the yard parallel to the transformer banks is a 110-kv. bus separated from the transformers by a distance sufficient to provide generously for the 110-kv. bus breakers and disconnecting switches. Each of the two outgoing 110-kv. transmission lines is connected directly to the end of one of the two buses through an oil circuit breaker and single set of disconnecting switches on the line-side of the breaker. The lightning arresters are on the line-side of all other equipment. Plans for future development of the system provide for removal of the line breaker to another location. The bus circuit breakers then will be used to switch the transformers directly onto the transmission lines.

A 38-deg., 450-ft. inclined tramway operates between the power house and the top of the canyon near the switching and transformer yard. This tramway has various capacities of from 8 to 40 tons, depending upon the number of parts used in the load line, and was used to handle all power house equipment. Two drums are provided on the winch and the change from 8-ton capacity using a single line to 40-ton capacity using a 5-part line can be effected quickly. Both push button and manual control are provided.

Fig. 5. Gravel bank which furnished all aggregate for dam and power house. This view was taken in September, 1925, and shows the partially finished dam at the right.

Transmission

Right-of-way for the transmission line varies from 100 to 400 ft. in width and traverses a country almost totally unsettled. Acquisition of this right-of-way proved the easiest and cheapest way of obtaining the right to cut down dangerous timber that stood within falling distance of the power lines. The timber cut varied in size from brush to fir trees 5 ft. in dimeter.

Both lines are carried on wooden H-frame towers constructed of minimum 11-in.-top cedar poles averaging slightly over 60 ft. in length. Crossarms on standard towers are made up of two 4 x 12-in. pieces 31 ft. 8 in. long bolted together on opposite sides of the poles and spaced by means of 9 x 12 x 20-in. blocks placed at the points of attachment of the insulator strings. The same arm construction is used on dead-end or semi-anchor towers except that 6 x 12-in. pieces are used. The two lines are separated 54 ft. center to center and

Fig. 6. Double-circuit transmission line crossing Skokomish flats.

conductors in each line are spaced 15 ft. apart. The average span is 725 ft. and the maximum span carried on wooden towers is 1,300 ft. The conductors are 3/0, medium-hard-drawn copper for the first five miles down from the power house. At that point the second plant will be tied in and the conductor is 300,000-circ.-mil copper for the remaining 39 miles into Tacoma with the exception of the Narrows crossing which is 1¼-in. plow-steel cable.

Lines are of the free-running type with few dead-ends. High-strength insulators are used in the suspension strings on semi-anchor towers located at advantageous points approximately a mile apart. These special towers use the large 6 x 12-in. crossarms and are side-guyed to withstand the maximum designed overturning effort of 6,000 lb. per conductor. Angle-guys are used on intermediate suspension towers instead of crossarm braces. Seven standard Locke units are used in suspension strings and eight Locke high-strength units for semi-anchor and dead-end positions.

Natural obstacles met with in line construction included 2½ miles of right-of-way across the tide marsh or flats where the Skokomish River empties into Hood Canal, the water crossings at the arms of Puget Sound known as North Bay, Henderson Bay and the Narrows. Standard H-frame towers were used on the Skokomish flats except that the towers near the river and towers that might be endangered at high tide by floating objects were supported at each tower leg with 4-pile dolphins bolted and lashed to the legs with galvanized steel cable. Guys for these towers were secured to piling instead of to anchor logs. The North and Henderson Bay crossings each are about 2/3-mile long and necessitated the use of steel towers placed on concrete piers located at points of shallow water. The Narrows was crossed with a single span 6,241½ ft. long, the longest transmission line span in the world. (See *Journal of Electricity*, Apr. 1, 1926, page 264, for more complete description of this span.)

Double-circuit steel towers were used between the Narrows and the Cushman substation in Tacoma, a distance of 2 miles. The last mile of the distance is over a city street where the towers are placed in the center of the street, one to the block.

Battery Assembly Plant Installation to Accommodate Future Growth

STORAGE batteries provide an index of the increased use of automobiles and radio in the United States. The growth of these two has brought about a corresponding use for batteries and as a consequence the business of providing them is growing constantly. In this article is described a modern and well planned electrical installation in the Kay Motor Supply Company of Los Angeles that is designed to use all available material formerly employed in an old plant and at the same time provide space for equipment which may be needed to meet the future demands of this expanding business.

THE demand for storage batteries is always an excellent indication of the extent to which automobiles and radio sets are being sold. On the Pacific Coast, with good roads and favorable atmospheric conditions the increasing demand for storage batteries presents the dealer with a problem which is difficult of solution. At least the problem which faced the Kay Motor Supply Company of Los Angeles, dealer in Exide batteries, gives proof to this situation.

Early in 1925 the demand for its product had become so great as to show conclusively the necessity for larger quarters and the latest type of equipment. A careful survey was made of the amount of business which had been enjoyed during previous years and an estimate was made of possible future business demands.

A site at 18th and Hope Streets was selected as being suited to this company's needs, and a beautiful building, a part of which was one-story and part three-story, was erected. On the Hope Street side is located a large service department with open space along the full width of the building. On the 18th Street side is located the three-story section, housing a complete motor supply department on the first floor. In the rear of the supply department is located the receiving and shipping departments, with large freight elevator serving all floors from basement to third. The loading platforms are on the rear alley, and are so designed that trucks may drive in under an overhanging portion of the second floor.

The stock storage space is located in the basement. The basement also houses the generator room where the motor generator sets are installed The second floor is occupied by the general offices and accounting department. Part of this floor is also devoted to stock storing for the motor supply department. On the third floor are the assembling and charging department, and also the private offices of the firm's executives. An automatic passenger elevator and stairs in the front section of the building provide access to all floors.

In the *Journal of Electricity*, Feb. 1, 1926, p. 108, appeared an article dealing with the motor-generator equipment and control system installed in this plant. Likewise interesting is the battery charging layout which has presented some unique problems from an electrical standpoint.

Both utilities serving Los Angeles supply 250-volt and 500-volt direct current as well as alternating current for power. To discourage the use of direct current, however, in new installations a premium of 20 per cent is charged on direct current above the regular price for alternating current.

At the former location of the Kay Motor Supply Company direct current taken from the street mains at 110-220 volts was supplied to the battery charging equipment. In planning the set-up for the new plant it was necessary that first consideration be given to a motor-generator layout driven by alternating current motors in order to take advantage of the lower alternating current cost.

It was desired to salvage as much as possible of the equipment used in the old plant. This equipment had been in service for a number of years and consequently was more or less obsolete and in poor condition mechanically. Most of the section switches, sliders, and resistance coils on the separate banks were in poor shape.

In accordance with universal practice at that time these banks were built for side-wall mounting, presenting a set-up which was very unhandy for operation and practically inaccessible for making repairs. In the new plant the owners desired to eliminate these objectionable features and also to conserve floor space as much as possible.

By an ingenious arrangement these desires were realized after the old banks had been torn down and the parts renewed and reassembled. The brackets which formerly had rested against the wall were sawed off and the frames drilled at each corner to accommodate hanger bolts carried on suspension hangers designed for ceiling mounting. This arrangement is shown in Fig. 1. The weight of the banks is adequate to provide the necessary rigidity when the regulating contact sliders are operated without the use of additional bracing.

To conserve floor space and to provide the maximum of convenience the tables carrying the batteries to be charged were mounted on castors, providing a vehicle which one man can handle with ease. In this plant the batteries are received in a knocked down condition from the eastern factories, the plates having received only the forming charge. After being assembled and the electrolyte added they are ready to be placed on charge. This charge averages 3½ amp. for 120 hr. The batteries are handled in sets of eight with two sets to each truck. Two trucks are placed side by side under each charging bank.

As there are 13 charging banks, it will be seen that 416 batteries can be handled at one time with the present equipment. Aisles 2-ft. wide are provided between each set of two trucks and an aisle 4 ft. wide is provided through the center of the room between the rows of trucks. This arrangement gives extreme flexibility in handling the battery sets and permits any truck to be moved without disturbing the set-up.

Battery Charging Lead System

A unique arrangement was used on the battery charging leads connected to the resistance banks. These leads are made of 30 per cent Para rubber (without braid), and the usual type of snap connector is fastened to the end of each cable. As the specifications called

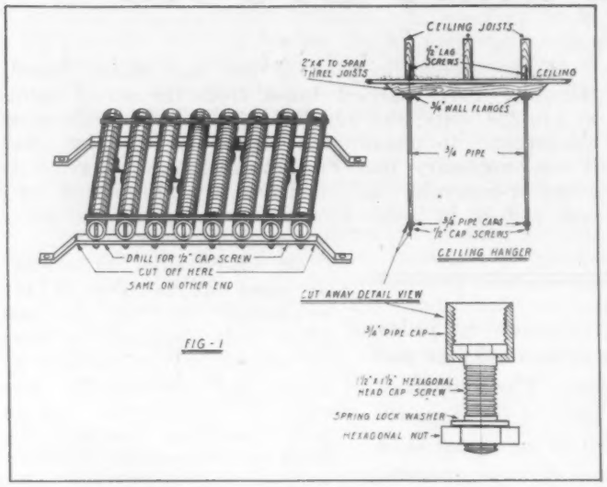


Fig. 1. Details of the remodeled rheostat banks and the ceiling hangers.

for all equipment to be suspended from the ceiling it was necessary to provide some means of keeping these cables out of the way when not in use.

This was accomplished in the following manner: Hardwood blocks were attached to suspension pipes and porcelain-covered cupboard door knobs were screwed to these blocks, four on each side. The four positive cables were brought out of bushed holes, provided on one side of the cast iron terminal fitting, and the four negative cables were brought out in a similar manner on the opposite side of the fitting. Each cable was then knotted about the groove in one of the cupboard door knobs.

On the face of the hardwood blocks were painted the plus and minus signs designating the polarity of the cables on each side. When any pair of cables is not in use each cable is snapped on the head of the cupboard door knob to which it is attached, using its terminal snap connector, and is thus quickly disposed of until again needed. To further reduce the hazard of wrong connections, the positives and negatives of

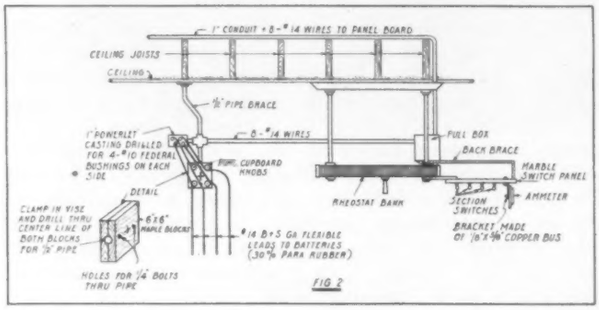


Fig. 2. A side view of the ceiling suspended rheostat bank layout.

three pairs of the cables were spotted with colored paint at a point near the hardwood block and also near each snap connector on the cable end.

The colors used were red, blue and yellow, with the fourth pair of cables left unmarked. This marking scheme is carried out on all banks, with each cable placed in the same relative location on each of the banks. This provides a means of readily identifying the leads connected to each set of batteries under charge and simplifies the testing of the equipment in case of trouble.

Redesign Panel Boards

In rebuilding the old equipment to meet the new code standard of construction, the panel boards came in for their share of attention. These were formerly of the double fuse 110-220-volt type and as the new code requires panel boards to be of single fuse design, it was decided to rebuild them. The motor-generators are of the two-wire, 125-volt type and the manner in which the panels were rebuilt is shown in Fig. 3.

The electrical contractor was enabled to make a neat installation of the conduit from switchboard to panel to resistance banks by taking advantage of the fact that an attic space 4 ft. high covers all parts of the battery room. All conduits were concealed as far as possible, an individual 1-in. conduit, containing eight No. 14 wires, being installed from panel board to each bank.

The predominant idea impressed upon the contractor was that he must provide ample space for the placing

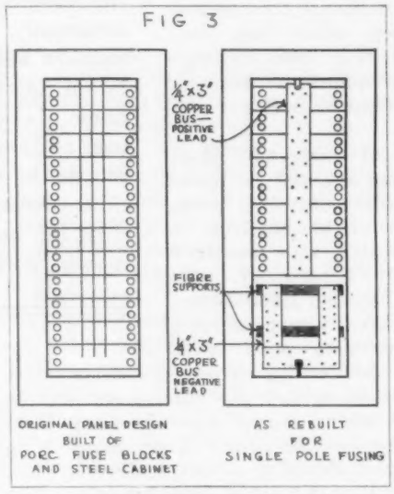


FIG 3
¼"x3" COPPER BUS—POSITIVE LEAD
FIBRE SUPPORTS
¼"x3" COPPER BUS NEGATIVE LEAD
ORIGINAL PANEL DESIGN BUILT OF PORC. FUSE BLOCKS AND STEEL CABINET
AS REBUILT FOR SINGLE POLE FUSING

Fig. 3. How the original panel was rebuilt for single pole fusing.

of additional future equipment. The owners decided that an additional 15-kw. motor-generator set would be ample to provide current for the future. As the present equipment consists of one 15-kw. set and one 25-kw. set this would bring the ultimate plant capacity to 55 kw., normal rating, with a possible overload capacity of 25 per cent additional.

In Fig. 4 the incoming alternating current switchboard is shown. This consists of an angle-iron frame anchored to the rear wall of the building in the basement. On this frame are mounted the main service and motor control switches, the automatic compensators, the interlocking control buttons, the necessary wiring gutters and the current transformer cabinet. It will be noted that the power company's meter is located where it will be the least subject to mechanical injury. In the center of the angle-iron frame is the space left for mounting the control equipment for the future additional 15-kw. set. This view also shows the present 25-kw. set and the adequate space provided around the equipment. It also shows part of the heavy wooden railing enclosing the equipment.

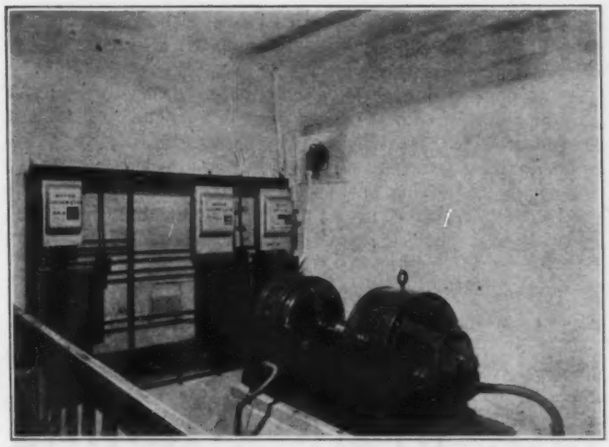


Fig. 4. The incoming alternating current switchboard and a 25-kw. motor generator set.

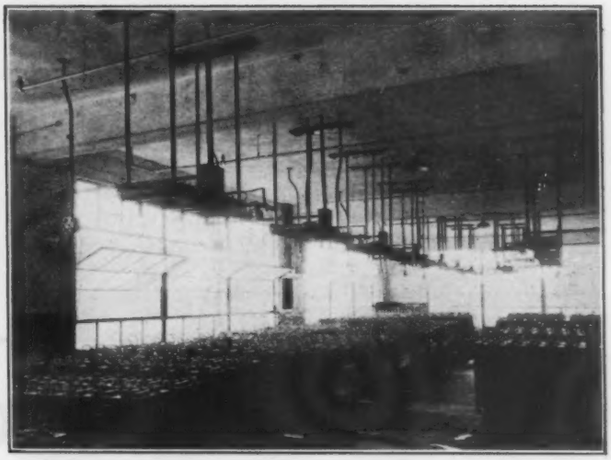


Fig. 6. The battery charging room on the third floor.

Protective Equipment

Fig. 5 shows the direct current switchboard located in the battery room on the third floor. A close inspection of this picture will reveal a number of interesting features. As explained in the previous *Journal of Electricity* article already referred to the entire plant was designed to be as near fool proof as possible. With that end in view, the d.c. generator circuit-closing contactors, (shown at the top of the generator panels in Fig. 6) are controlled by time delay relays (shown at the bottom of the panels just above the interlocking control buttons). These relays have a maximum accelerating time delay of 30 sec. and are connected across one phase of the motor leads.

This method of connection gives an additional delay interval, directly in proportion to the acceleration time of the automatic compensators. The control coils on the d.c. generator circuit contactors are wound for 440-volt a.c. All interlocking control circuits are also 440-volt a.c.

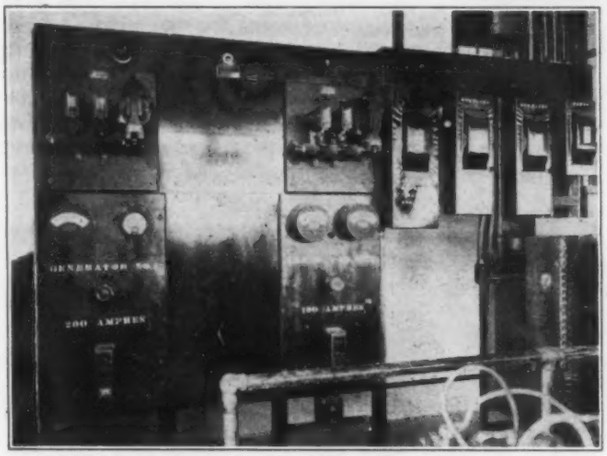


Fig. 5. The direct-current switchboard, located on the third floor in the battery room.

The action of the time delay relays is briefly as follows: Upon failure of the power company's current, the circuit-closing contactors are de-energized and open immediately due to gravity. Upon return of the service current the motors are thrown upon the line and again begin to operate. The construction of the relays is such that the delay action can be regulated up to a maximum of 30 sec. This predetermined time interval allows the generators to reach full generating speed before the contactors close, thus preventing current reversal (due to battery feedback) with consequent damage to the equipment.

Above each generator panel will be noted a red color cap such as is used on electric signs. These indicate which generators are operating. The color caps permit the use of clear lamps of small candle power. These red indicators can be seen from any point in the battery room and indicate at a glance any trouble on the generator equipment or circuits.

In the center of the switchboard, between the two generator panels, is a blank space for the control panel of the future generator. The space between the bottom of the panels and the floor is filled with a metal screen of ¼-in. square mesh. This provides free ventilation to the rear of the switchboard.

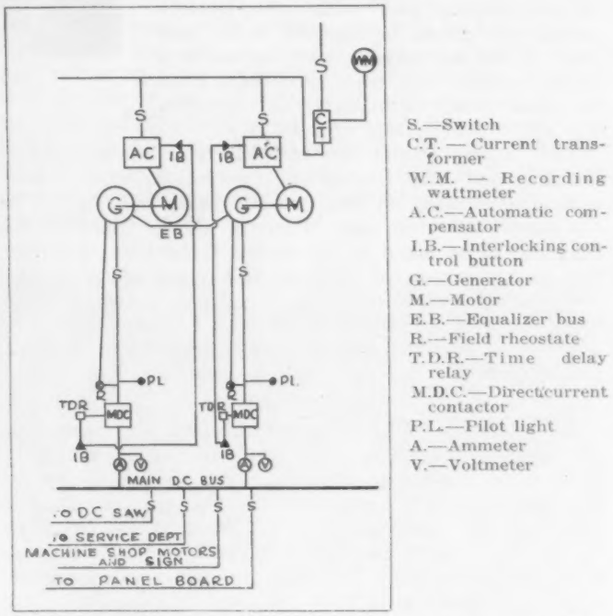


Fig. 7. Schematic wiring diagram for the Kay Motor Supply plant.

Battery Room Arrangement

Fig. 6 is a general view of the battery room, but does not show the switchboard (which is located in

the upper right-hand corner). This picture shows very clearly the large amount of thought given to the matter of adequate natural light and ventilation. The third floor is higher than any of the surrounding buildings and fresh air and sunshine are unrestricted.

It will be noted that the banks are so mounted that the front edge of each resistance bank is on a line with the front line of the battery truck. This is done so that the slider contact handles are easily reached from the center aisle. The cable terminal fittings are mounted on a line with the center lines of the battery trucks from either direction. This is done so the cables can be reached readily from either side of the side aisles. Fig. 7 shows a schematic diagram of the wiring layout of the plant.

In summarizing, the general layout of this plant presents an example of the modern trend in battery assembling plants, what may be accomplished in rebuilding obsolete equipment and the results possible when adequate thought is given to all details before the plant is built. The electrical installation was made, and all electrical equipment was furnished by The Los Angeles Electric Works, Inc.
urshowsuetnzg

A New Electrical Code in the Making

And a Suggestion as to How It Might Be Expedited

By Ben C. Hill

President, California Association of Electrical Inspectors

THE electrical industry has been looking forward to the time when it could work under one uniform code, doing away with varying local rules and regulations. The National Electrical Code and the National Electrical Safety Code are recognized as the best known standards. Yet those who are charged with the duty of applying them have found in actual practice certain conditions not definitely covered. This has made it necessary to create additional regulations. This situation has constituted the chief cause for the formation of local rules and has presented a difficult problem to solve.

B. C. HILL

The present procedure in code making is not keeping pace with new developments and should be speeded up to take care of the advancing times or we will be confronted with more local codes than we know what to do with, all of which are apt to vary from city to city.

The fathers of the National Electrical Code, namely the National Fire Protection Association, have a field secretary working on this problem today but the job is too massive for one man to handle alone. Most of his time has to be taken up in Article Committee meetings and in making investigations in various parts of the country. His recommendations and changes are thrust upon the Article Committees in such numbers that it is impossible for these committees to complete their work in the limited time set for the meetings.

Code Making Problems

The problem of making an adequate code, complete and specific enough to meet all requirements of actual practice and yet not become so complicated as to be understood only by engineers, is not an easy one to solve. In the first place the code must be simple in its language. It must be clear cut and definite in expression, leaving no room for doubt or argument. It must be fair to manufacturer as well as to contractor and engineer.

It would be simple enough, perhaps, to write a code which from a theoretical standpoint might be considered perfect. Yet it will be of very little use to the industry and the public if it cannot be interpreted and followed by the average contractor, or even his wireman. First of all, therefore, it must be practical. Second, it must be definite and concise. And always it must be simple and as short as possible.

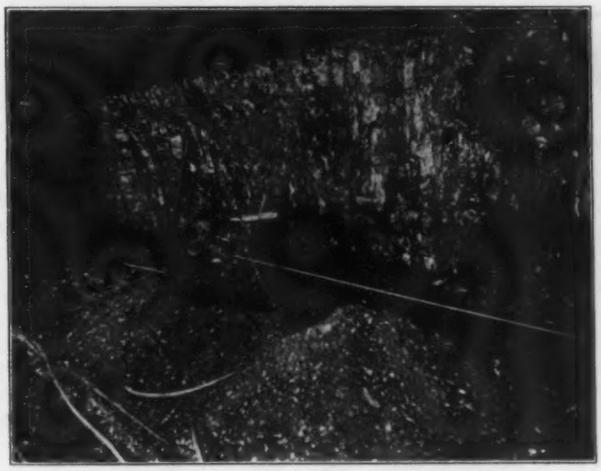
This is no easy set of specifications for a code-making body to meet. The danger is that too much time may be lost in argument and controversy. The manufacturer of equipment wishes the code to be favorable toward his product. The inventor of a new product wants his material included and given recognition. The contractor wants a code that will not make his job too complicated or too intricate to handle. The central station wants protection afforded its equipment through correct use of its energy and it desires satisfaction of its customers. And the public wants electric service provided in a way which will be adequate and safe and without too much expensive red tape.

The personnel of the actual code makers is that of a group of conservative and fair minded men. Naturally they do not want to make new rules nor even write changes for existing rules unless they are convinced that conditions justify doing so. Therefore, national code making has been slowed down.

A Suggestion

Would it not speed up this job if it were to be assigned to a very small number of representative men, each of whom could devote his full time to this work? If one of the group had the talent to express himself plainly in writing, using as simple language as possible, having had both technical and practical experience, would it be possible for him to clear up some of the misunderstandings due to present wording of the code? The others of this group might be qualified by having had both code making and code application or inspection experience. When this group's work had been completed the results of its deliberations could then be sent to the Article Committee members for criticism or comment. When approved it could next be passed on to the Electrical Committee and American Engineering Standards Committee for adoption.

These thoughts are meant in no way to criticize or cast any reflections upon the present method of procedure in code making. Rather they are meant to express an idea which, if it has any merit, perhaps might help to speed up the job for an adequate code.



Shortwall machine equipped with 50-hp. motor undercutting 9-ft. vein. Note flexible rubber cable in foreground.

Specially designed scraper used for loading. One of the 1,000-watt flood lights is at the left.

Floodlighting Used to Facilitate Coal Mining Operations

By D. C. McKeehan

Chief Electrician, Union Pacific Coal Company, Rock Springs, Wyo.

THE many uses for electricity in the modern coal mine are not generally realized, either by the public or the electrical industry. Tradition has it that coal is mined by pick and shovel in dark holes in the bowels of the earth while on the contrary through the application of electric light and power the process has been raised to a high degree of efficiency.

One of the most recent applications, now widely employed in the mines of the Union Pacific Coal Company, is the use of floodlights to expedite scraper loading operations. Exensive use is made of a special 1,000-watt, 220-volt, d.c. portable floodlight to light the face of the vein where mining is in progress. A high intensity of illumination is obtained that greatly facilitates all of the mining operations.

A brief description of the scraper loading process will indicate how extensively electricity is used in a modern coal mine. The accompanying photographs show operations in one of the Union Pacific Coal Company's properties. As indicated the 9-ft. vein is first undercut to a depth of about 7 ft. with a shortwall machine driven by a 50-hp., 250-volt, d.c. motor. The coal face in this instance is about 200 ft. long. After the undercutting is completed the face is drilled with portable electric drills and then shot down, a pile of loose coal resulting. A specially designed scraper, provided with both pull and tail ropes, is used to drag the coal from the piles onto a conveyor, also electrically driven, which carries the coal to the cars which ultimately take it to the surface. The scraper is operated by a hoist equipped with a 125-hp. motor. As the coal is cleaned up wood props are set approximately 5 ft. apart to support the roof. Subsequently the props are withdrawn and portions of the roof allowed to cave, thereby relieving the pressure.

As shown in the pictures it is possible with the scraper to clean the face of the vein sufficiently for the shortwall machine to begin undercutting operations preparatory to further shooting.

Face of vein after being drilled with portable electric drills and shot down.

Scraper cleaning face of vein preparatory for further undercutting with shotwall machine.

BLONDES PREFER

by ANITAS LOST

A GENTLEMAN came around the other day, leaving really intreeging pamflets about electricle washing machines, and it seems he really did know quite a lot about what us girls who keep house have to do. I mean he was very much interested when I told him that Archie and I send all our things to the laundry because I tried to do our washing at first but had to stop on account of looking at the washboard so long it corrigated my vision for some time afterwards and also keeping my hands in water made them quite swole and shrunk until the skin resembled the inside of a chickens gizzerd. The gentleman seemed to be simpethetic and seemed to think we could save really quite a lot by getting an electricle washing machine.

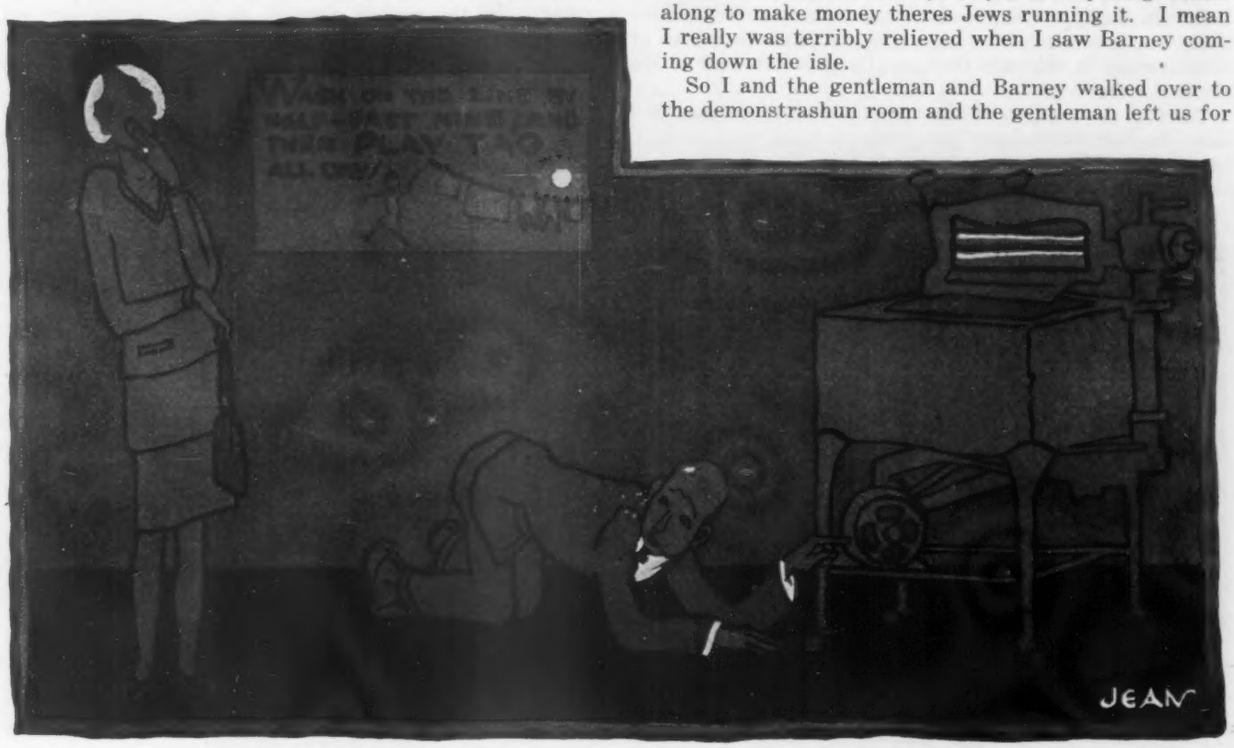
It seems the gentlemans name is Barney and he used to be in the Feel-Silk Hosiery line before he started selling washing machines. The gentleman says his wife made him really change his vocashun after the hosiery firm started having their agents give fittings or something. His wife said if he really had to be a bootlegger why not carry something on the hip besides a girls stockings. So then he said he would go into the electricle washing machine business and come clean.

So then he told me that a girl like I who has all her own housework to do really should have some electricle servance around the house to help a girl out. So then I promised him I would come down to the store the next morning and let him give me a demonstrashun. I mean I talked it all over with Archie and he said now that we have the car paid for I could buy a washing machine if it didn't set him back too much. Then Archie and I had quite a little quarrel on account of I said it would be such fun to run a complicated machine such as an electricle washer and Archie said about the only utensil I could run with a head like mine would be a vacume cleaner.

So I went down to the store and I really had quite an obnoxious time at first because a gentleman said Barney was out canvasing, so I suppose they sell canvas and quite a lot of other materials to help out the electricle washer business. So I let another gentleman who seemed to be very affible take me around and show me th electric applianses. It seems he is a quite good salesman but when we got in close conversation and I saw how bald he was and dandruff on his collar and other insidious things, I could not help thinking that all salesmen which sell we girls electricle applianses should really read the Saterday Evening Post advertising more thorough, But anyway I became quite intreeged over some of the applianses. I never seemed to think much about them before as really a girl like I who has to do all her own housework does'nt have time for much shopping that isn't something quite urgent. I mean some of them were shiney and quite cute and would really save a girl a lot of time and hand loshun.

The gentleman said he never in his life had a prospect which seemed to take such intelligent interest in things and I told him my fathers brother was a motorman in Grand Rapids which is really why I come natural by machinery and other technicle engines. I told the gentleman I thought it was really quite dumb how you could push a button on one utensil and have it heat up and push a button on some different other utensil similar to a kitchen cabinet and have it start in to freeze. He began to explain something intrikit about currence and votes and generations, but a girl who has an active mind such as I, finds deep talk obnoxious after awhile so I yawned and asked him to say it in United States. Then he said, well if it comes to that its all a simple matter of juice and I said, yes thats what Archie always says, if anything comes along to make money theres Jews running it. I mean I really was terribly relieved when I saw Barney coming down the isle.

So I and the gentleman and Barney walked over to the demonstrashun room and the gentleman left us for



ELECTRICLE SERVANCE

INFAMOUSLY IMITATING THE ILLUSTRATIONS by RALPH BARTON

another good prospect. It seems this particular washer was a Play Tag put out by the Gurley people, and it seems there slogan is "Fill In Your Line by Half-Past Nine and Then Play Tag All Day." So Barney filled it up with suds and put in some clothes and pressed the button. It seems the principal used on this electricle washer is what they call a circuler agitater and it really is quite intreeging. But I said to Barney, haven't you got one that is more artistic than this one because a girl who has to stay at home as much as I ought really to have attractive furniture. And it seems his store really features several brands but it is a thing called sales sycollogy to show the most expensive ones first. He showed me one kind that had a pair of big tin jumpers that hopped in and out of the suds one after another which Barney said was another way of aggitating dirty fabrics. And it seems there was another stile where you put the clothes in a barrel with eyelets punched all over the outside of it, and the barrel lies on its side and its a rotarian type Barney says, and it turns the clothes over and over and finaly rolls all the dirt out. I told Barney it had so many revolutions it reminded me of Mexico, I having read the joke the night before, but evidently he has never had much education because he didn't seem to think the remark was so hot.

So then I asked him the price and I thought it would really be quite reasonable because it was made of only a bunch of tin and bolts and a very insignifigent looking little engine, and when he said a hundred and ninety dollars I nearly became histerical. I mean Barney had to take me over to a desk and give me a clove life saver, and wrote down on a piece of paper just how much I would save in laundry bills in a year and it seems a girl really can be awfully shrewd by buying up electricle washers at $190 on a easy payment plan. So then I decided to get one but I told Barney to send out any machine he thought was the most attractive so I would be surprised when it was delivered.

Really when I got home it seemed I became terribly excited because here it was my birthday and I had forgotten all about it. So it seems Archie had been to an electricle store and had bought me a vacume cleaner and a Hellvinaire, which is nothing but an electricle refrigerator. It seems the electricle manufractures want to do away with dirty ice mens feet on a girls clean kitchen floor, but Im sure our iceman was a very nice boy and didnt make tracks on account of our old refrigerater being an outside icer.

The vacume cleaner has 32 attachments and I don't know how they expect a girl like I to get much use from them as it seems there is only one place on the end of the pipe to hitch the attachments on to. I mean there really is even an air tool for pulling flees off of pet puppies, and a blower for drying hairs or eyes or anything else which can be dried by being blew upon, and it seems there is a perforated blower which squirts powdered sugar upon doughnuts which will be quite a lot of assistants to a girl who has to keep house and do all her own cooking at the same time.

But really the biggest thrill of all is the Hellvinaire which seems to turn out little panfulls of ice cubes every little while, which Archie says shows the manufractures meant to be on the square. So the little cubes are quite cunning and are just as cold as real boughten ice.

So Archie said if I could just write down my true confessions of a girl who does all her own housework and then finds out how nice it is to get some electricle servance, we might get enough money to pay the first enstallment on the appliances. So I said I couldnt make a story of such a kind very spicey and Archie said, "Yes you can, honey, its bound to be a labor-savoury article."

—Ruth E. Creveling

Development of the Electric Brooder

By Ben D. Moses

Executive Secretary, California Committee on the Relation of Electricity to Agriculture, University Farm, Davis, Calif.

AMONG the advances that have been made in attempts to imitate nature, there is nothing more interesting than the application of electricity to the brooding of baby chicks. In the old-fashioned days, a fussy hen was depended upon not only to hatch the chicks, but to rear them as well. She hustled food and water for her babies, and instinctively protected them against exposure. She did a good job, but sad to relate, was fated to share her responsibility with a soulless machine that neither clucks nor fusses, but raises chicks just the same.

This mechanical hen is called a "brooder," and it, like many other applications, had its origin in the mind of the farmer. He had reared many an orphaned chick in an improvised brooder made of a wooden box or basket, and kept warm by being placed in the kitchen. The successful operation of this expedient encouraged experimenters to construct brooders that would satisfactorily replace "mother hen"—the idea being to nurse the chick along until it was sufficiently feathered and had the vitality to keep its own self warm. In this attempt to imitate nature, heat was provided over the backs of the chicks and soft curtains were substituted for feathers.

There seemed to be a profitable field for a machine that would care for a great number of chicks, and so the manufacturers' attention became focused upon the problem. Brooders of various shapes and sizes using coal, gas and oil for fuel were built, and they operated so satisfactorily that poultrymen purchased baby chicks from hatcheries and raised them with mechanical brooders.

This practice gave rise to the question, "Why not use electricity, which is clean, safe and subject to simple temperature control?" The problem looks simple enough, but is demanding the combined efforts of the poultryman and engineer for its satisfactory solution.

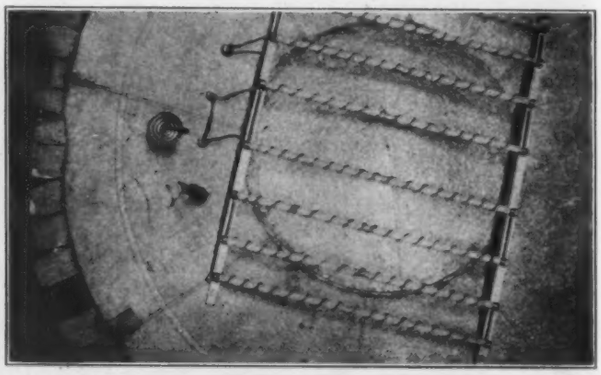
The first electric brooder consisted of a hover either supported on legs or hung on a cord from the ceiling, with a soft curtain around the outer edge. It was heated by electric elements built up of resistance wire wound on a frame and suspended from the hover. The farmer used this piece of apparatus and as a result lost many a chick. Some of the experimenters were disgusted, some encouraged, but all hopeful. A refinement in the form of a thermostat to control the temperature was introduced, but still the brooder was not eminently satisfactory. The chicks would huddle together and the moisture given off would condense on their bodies, causing what the farmer called "sweating," the results of which were disastrous.

Those that looked upon the electric brooder with disfavor based their conclusions chiefly upon two reasons, first, the tendency of the chick to "sweat," and second, the disastrous effects of interruptions in electric service. Painstaking experiments on the part of the manufacturers and poultrymen to find the real cause of "sweating" and to apply a real remedy, bore fruit. Ventilation was recognized as an all-important factor, not only in removing the foul air, but in the elimination of "sweating" by the removal of the moisture from beneath the hover. The problem then became one not only of producing heat and regulating it, but one of furnishing adequate ventilation as well.

One poultryman raised the hover and placed beneath it a false floor of ordinary lath and burlap; another led fresh air up through a pipe from beneath the floor and installed a heating element in this riser to force the circulation; another built a false floor with heating coils on the underneath side, and an air flue up through the center to the hover; another induced circulation by placing ventilators with dampers in the top of the hover, and still another suspended the hover high enough above the room floor to take advantage of the room circulation.

But ventilation without harmful drafts is not always easy to obtain. Any plan that induces air to circulate through heating coils and to flow outward from the center of the hover, tends to obtain uniform temperature distribution and also to have a region of warmth around the outside edge where the chicks like to lounge. On the other hand, an arrangement that discharges the foul air from the center of the hover tends to draw the cool fresh air inward from the edges and results in a region under the hover itself where the chicks are exposed to a cold draft. Recent studies of electric brooders have developed certain important conclusions:

Convection type electric brooder of the kind popular among California poultrymen.



Under side of same brooder shown in preceding illustration showing arrangement of heating element and thermostat.

1. There are two methods of heating with electricity: one depends upon convection or conduction or both, using either black heat or glowing elements, while the other depends for its heat upon radiation from glowing elements.
2. The ventilation problem is of great importance; especially is this so in cold or humid climates.
3. The brooder room or house must itself receive careful thought. A south exposure on a sunny slope, protection from the wind, tight or well insulated walls and a well-designed ventilation system are all important helps to satisfactory brooding.
4. Proper space should be provided; 7 sq.in. per chick is generally considered to be the minimum, unless the brooder is a room heater in which case this area may be modified.
5. A connected load from one to two watts per chick and an energy consumption of from one to three watts per chick per hour seems reasonable.
6. Thermostatic control insures uniform temperature and should be installed.
7. Either the plain convection or the radiant type have very little heat storage capacity rendering power interruption hazardous, while the floor-heated and some of the heavier wooden, curtained brooders, may be able to tide over short interruptions, with little or no bad effects.

In making their study, the California Committee on the Relation of Electricity to Agriculture installed meters on 26 brooders and took readings of power, temperature and mortality, the accompanying condensed table showing their findings:

A CONDENSED TABLE OF THE RESULTS OF TWO YEARS' OBSERVATIONS ON ELECTRIC BROODERS, BY THE CALIFORIA COMMITTEE ON THE RELATION OF ELECTRICITY TO AGRICULTURE.

	Convection Type	Radiant Type
Total chicks placed under brooders	21,940	10,874
Total chicks turned out	18,121	9,394
Total power required to heat brooders	8,596.9 kw-hr.	13,824 kw-hr.
Total connected load	28,467 watts	20,376 watts
Average time for brooding	1,006 hours	1,209 hours
Per cent time power on	30.2%	56.1%
Average connected load per chick put under hover	1.29 watts	1.87 watts
Average consumption per chick turned out	.47 kw-hr.	1.36 kw-hr.
Average consumption of energy per chick turned out per hour	.467 watt-hr.	1.125 watt-hr.

The poultryman and the chick are two other factors that must also be considered. The purpose of the poultryman may be quantity production or quality production, or optimum quantity-quality production. This is illustrated in the comparison of two poultrymen. One placed 1,200 chicks in a brooder, while his neighbor placed only 500 in the same type and size brooder. The first man reasoned that he could have a higher per cent mortality and make more money by raising even an inferior chick, because they were to be sold either as fryers or as stock layers; the second man, however, wanted to produce hens with high laying records, and they must be a superior product, and he would consider a population of 1,200 very crowded.

Not only may crowding turn out a greater number of chicks, but it also lowers the heat required, because of the body heat given off by the chicks themselves. That each chick is itself a source of heat is shown clearly by the following experiences. One of the brooder houses studied permitted of metering five brooders in a row, all under the same roof, and operating under very uniform conditions. No. 1, at the west end of the building was charged with 300 chicks and required 257 kw-hr. No. 2, with 400 chicks, required 187.2 kw-hr. No. 3, with 400 chicks, required 152.3 kw-hr. No. 4, with 400 chicks, required 212 kw-hr. No. 5, with no chicks, required 293 kw-hr. All were run simultaneously for the same length of time, 672 hours.

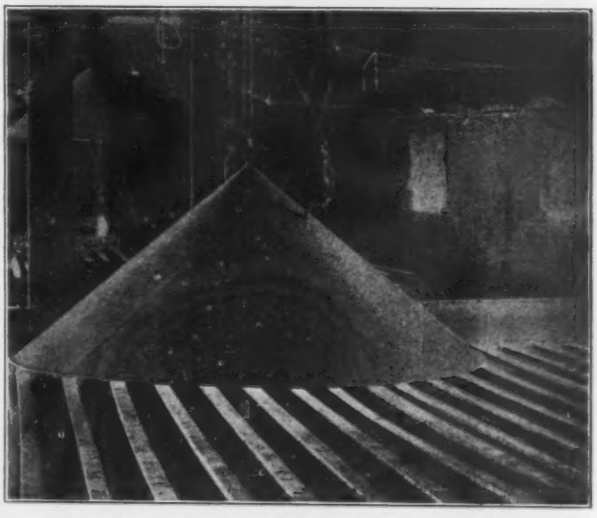
Poultry raising has become an industry, and its success depends upon the same factors affecting other industries, namely: product must be uniform, production costs low, and quality of product dependable. Production costs are affected by the quantity produced, the efficiency of the equipment, the care of the operator, and the rates charged for power. The poultryman is willing to use electrically heated brooders even under present cost requirements, providing he is amply protected against loss from such things as "sweating" and the interruption of power.

It would seem then, that the three factors who have the destiny of the electric brooder in their grasp are the farmer, the manufacturer and the power companies. It is up to the farmer to efficiently organize his work, to study his operation costs, and to co-operate with the other two heartily. The manufacturer has for his obligation a continued study of brooder performance and the design and construction of brooders containing such features as temperature control, uniform distribution of heat, and ventilation control, which will overcome such objections as "sweating," overheating and chilling. The power company must put itself in readiness to serve the electrically heated brooders continuously without serious interruptions of current.

That the electric brooder is meeting the requirements of poultrymen is indicated by the continued growth in the number that is being used. A recent survey shows that there are between 1,000 and 1,500 electric brooders in use in California. For the purpose of studying the brooder problem, let us assume the lower figure, 1,000; let us also assume a connected load of 1 kw. per brooder and a load factor of 50 per cent, a brooding period of 1,000 hours, and that each brooder raises two lots of chicks each year. These assumptions are borne out in practice as being representative averages.

The total annual electric consumption, then, by this heating load would be 1,000,000 kw-hr. which, at two cents per kw-hr., gives a total annual revenue from this load of $20,000. Under present conditions there are at least eight times this many brooders of all kinds in use in California. With proper development, then, there is a potential market for from 5,000 to 10,000 electric brooders in the state. Not only is this an opening for manufacturers of electrical equipment but it also represents an attractive load for the power companies, coming in a winter season when irrigation is at its low point.

There are at present at least four manufacturers producing electric brooders in California and approximately 1,000,000 chicks are brooded each year with electric heat in that state. With costs as indicated by tests cited in this article, and with the success that is attending the use of electrically heated brooders, it seems reasonable to look for a considerable increase in the popularity of this appliance among poultrymen.



Radiant type electric brooder with roosts on floor for chicks four to five weeks old.

Engineering Practice

Transmission Substation Provides New Regulating Point

Ring Control Bus and Automatic Fire Protection are Features of New 110-kv. Power Source Serving Upper San Francisco Bay Area

By E. A. CRELLIN, Assistant Engineer, Division of Hydroelectric and Transmission Engineering, Pacific Gas and Electric Company, San Francisco

A RAPIDLY growing industrial district in the vicinity of Antioch and Pittsburg, Calif., and extending on around the southern shore of upper San Francisco Bay, has greatly increased the demand for power and taxed the capacity of the 60,000-volt lines supplying the territory. Contra Costa substation was built to relieve this condition and improve service to the growing industries by bringing in additional power from the Pit River plants.

Contra Costa substation is located about two miles east of the city of Antioch just off the Victory Highway, and is the present southern terminus of the extension of the 220-kv. transmission line south from Vaca-Dixon substation. This line for the present is operating at 110 kv., but all construction of the line has been made suitable for 220-kv. operation. The layout at Contra Costa substation has been planned for future conversion to 220 kv. when the lines are extended on south to their final terminal substation in the vicinity of Newark and placed in regular operation at 220 kv.

A panoramic view of the substation is shown in Fig. 1. At the left is shown the substation building, the high portion being the condenser bay and transformer untanking room and the low portion housing the 11-kv. switch and bus structures, main switchboard and other auxiliary apparatus. Immediately to the right of the substation building is the 110-kv. oil circuit breaker structure with its associated disconnecting and bypass switches. This structure will be removed entirely when the station is changed over for operation at 220 kv. The main transformer bank is shown in the center of the picture and in the right center the 60-kv. bus and oil circuit breakers with their disconnecting and bypass switches may be seen. At the right is the cooling tower for transformer water.

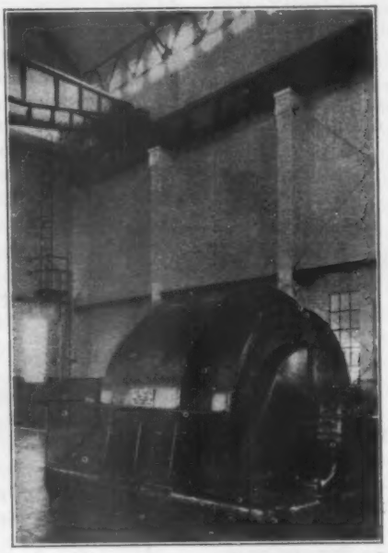


Fig. 2. Condenser room showing location of fire-protection equipment on 15,000-kva. machine, Contra Costa substation.

The substation building is a steel-frame, reinforced concrete structure. In anticipation of the continual growth of power demand to be supplied from this station it has been designed to permit of extension to more than twice it present size. The end of the building shown in Fig. 1 is of hollow-tile construction to permit ready removal when the time comes for expansion, and all design work has been carried out with the idea of permitting additions from time to time without disturbing the present equipment.

There is installed in the main bay of the building a single 15,000-kva., 11-kv. synchronous condenser for stabilizing voltage and affording power factor correction. This is shown in Fig. 2. Cooling air for the condenser is drawn in through the louvres shown in the front of the building in Fig. 1. The air then passes through the air washer shown in Fig. 3 whence it is drawn up into the machine windings and discharged into the room.

Fire Protection

An automatic rolling steel door is mounted at the top of the air washer and electrically operated to trip the door closed when the condenser differential relays function. This serves to

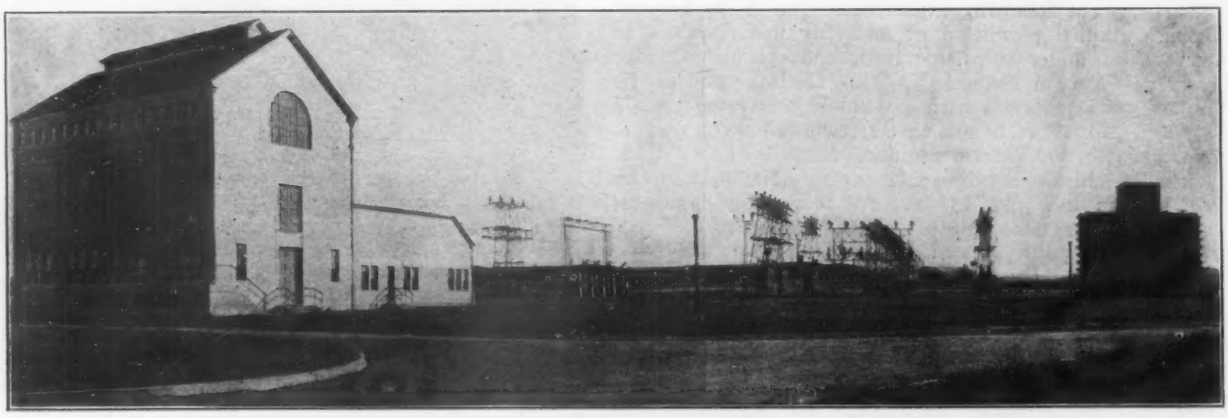


Fig. 1. Panoramic view of Contra Costa substation, Pacific Gas and Electric Company.

shut off all ingoing air and aids in smothering a fire, should one be started due to an insulation failure. In addition to the rolling door additional fire protection is secured through the use of sprinklers located in each end bell and

Fig. 3. Air washer showing automatic fire door, Contra Costa substation.

arranged to flood the windings with water when the fire valve is opened. To prevent any leakage water entering the manifolds, a 3-way cock is placed just above the main fire valve and is normally open to the room. Any leakage passing the gate valve will drain into the room. The handle of the 3-way cock covers the handle of the gate valve and the two are sealed with a meter seal. Thus it is necessary to break the seal and put the 3-way cock in the correct position for flooding the windings before the main gate valve can be operated to quench a fire. This valve arrangement may be discerned in Fig. 2. A pair of pliers is kept at the valve for use in breaking the seal on the valves.

Equipment and Arrangement

A 50-ton crane is provided for handling transformers or other equipment when repairs are necessary. The height over bushings of a 220-kv. transformer is such as to require a very high crane and consequently a high building. However, the height has been kept at a minimum by the construction of an untanking pit in one end of the building into which the transformers may be lowered when it is necessary to remove the core.

The single-story portion of the substation building houses the main switchboard, 11-kv. switch and bus structure, transformer cooling-water circulating pumps, storage battery and other equipment necessary or convenient for the operation of the station. The main switchboard is shown in Fig. 4 and it may be noted that ample room has been provided for additional panels. The two panels at the extreme left end of the board control the three 60-kv. line switches and the 60-kv. bus paralleling switch. The next panel controls the house bank. The left panel of the right-hand section of the board controls the main transformer bank, the next panel is for the control of the synchronous condenser, and the third panel is for the incoming 110-kv. line. A blank panel is provided for future high-voltage lines and the end panel contains recording meters on the vertical section and machine temperature indicating equipment on the bench section. The operator's desk and telephone switchboard are shown in the right foreground.

Property on which the substation is erected comprises approximately 60 acres. The building occupies but a small portion of this area, but the balance is necessary for the outdoor switch and bus structures as 220-kv. apparatus requires such a wide separation between phases.

The incoming line from Vaca-Dixon substation supplies a bank of three 10 000-kva. transformers with a fourth unit held in reserve as a spare. The transformers are star-connected with the neutral solidly grounded and are connected as auto transformers to reduce the voltage from 110-kv. to 60-kv. In addition to the main transformer winding there is a full-capacity tertiary delta winding for supplying 11-kv. for condenser operation. The 60-kv. side of the transformers feeds the main 60-kv. bus structure from which lines radiate to Herdlyn substation, South Tower substation and Columbia Steel substation.

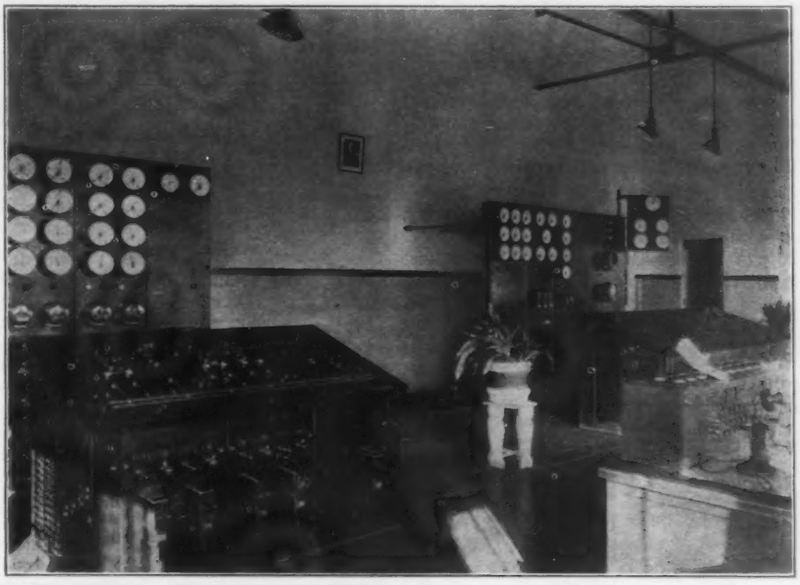


Fig. 4. Operating room and main switchboard, Contra Costa substation.

Ring-Type Control Bus

The main control bus for the operation of all oil circuit breakers, both present and future, is supplied from a 125-volt storage battery. This control bus is laid out as a ring bus and is fed at each end through carbon circuit breakers mounted on the station auxiliary switchboard shown in Fig. 5. Circuit breakers were used rather than fused knife switches due to the very heavy currents required to close the 220-kv. oil circuit breakers. Switches of 400-amp. capacity would have been required and fuses for such circuits were not considered desirable. Circuit breakers with overload trips accordingly were substituted. The ring bus is arranged for sectionalizing at each oil circuit breaker to permit feeding the breaker operating mechanism from either direction. This permits taking out of service for repairs any section of the control bus that may become damaged or grounded, without rendering any of the oil circuit breakers inoperative. The cost of such a ring bus is only slightly in excess of the usual simple bus, the additional cost being the extra cable and duct necessary to connect the outlying ends and the links or switches installed for the purpose of sectionalizing.

As was the case in the substation building itself, the bus structure and other apparatus in the yard have been laid out for very convenient extension. The problem of forecasting the development or growth of load is a difficult one and experience almost invariably has proved that the most optimistic provisions for the future have proved inadequate within a few years. Contra Costa substation has been so designed that it can accommodate readily any demands which the future may require of it.

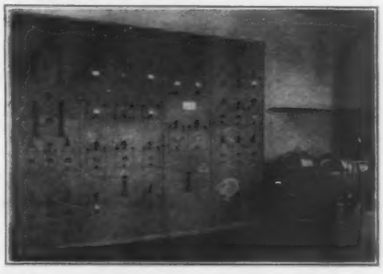


Fig. 5. Station auxiliary switchboard and equipment, Contra Costa substation.

Compensator Arrangement Obviates Use of Potential Transformer for Relays

By W. D. HARDAWAY, Superintendent of Transmission and Hydroelectric Production, Public Service Company of Colorado, Denver.

Impedence or so-called distance type relays have been installed for both line-to-line and line-to-ground protection on the 90-kv. transmission loop of the Public Service Company of Colorado. This most important unit of the company's transmission system serves to interconnect the Boulder Canyon hydro plant, the Valmont steam plant and the Denver terminal substation. This single-line loop effects the equivalent of a 2-circuit tie between the two prominent sources of power and the Denver load center. (See Fig. 1.) The importance of these lines necessitated a protective relay system that would lend itself to operating conditions and that would give the most rapid sectionalization possible in the event of line troubles.

These CZ relays require a source of potential which remains truly proportional to the line voltage during any system disturbance. Normally this would be accomplished by the use of potential transformers. However, the cost of such for 90-kv. service was prohibitive and it was necessary to supply the potential coils of the relays, through compensators, from potential transformers on the low-tension side of the 90-kv. transformer banks.

As shown in Fig. 2, these compensators are arranged to correct the voltage impressed upon the relays as a result of the current passing through the main transformers. Also they are adjusted to give the relays a true proportion of the line-to-line and line-to-ground volage at all times. The type

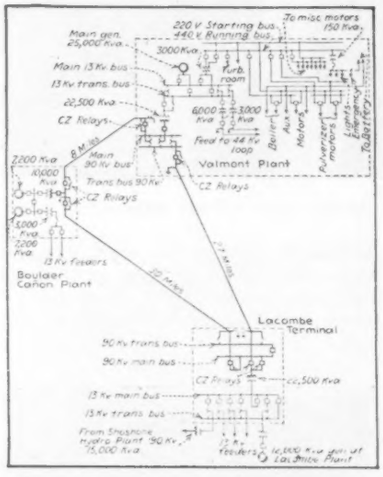


Fig. 1. 90-kv. transmission loop protected with impedance-relays.

KY compensators are arranged to neutralize the phase-balancing effect of the delta-delta-connected main transformer bank. Thus the collapse of voltage on one phase, due to a line-to-ground fault, is correctly indicated to the relays.

Compensator Scheme

A novel compensator scheme has been worked out to produce just the results desired. It may be seen (Fig. 2) that the potential impressed upon any line relay (a) will be the vector sum of

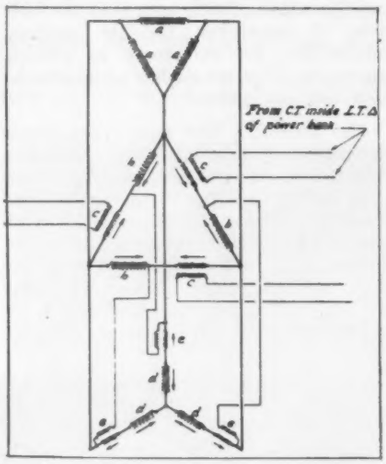


Fig. 2. Schematic diagram of potential circuits of impedance-relays as worked out to obviate use of high-tension potential transformers. (a) "Line" relay potential coils; (b) 120/1 potential transformer secondaries; (c) "KX"" compensators; (d) potential coils of "ground" relays; (e) "KY" compensators.

the potential transformer secondary voltage (b) and the voltage developed in the type KX compensator (c). For reverse current the compensator voltage is 180 deg. out of phase and hence will subtract directly from the potential transformer voltage. This compensator is similar to those used with automatic induction voltage regulators, but is set to compensate for the resistance and reactance of the main transformer bank rather than for line resistance and reactance. It therefore "corrects" the voltage applied to the relays for transformer drop and gives them at all times a true proportion of the voltage across the high-tension terminals of the power transformers.

Potential supplied to the ground relays (d) also is corrected by these same KX compensators. In addition type KY compensators (e) are installed to overcome the phase-sustaining effect of the delta-delta-connected power bank by applying a continuous "buck" to the voltage impressed upon the ground relays. Thus the collapse of voltage between one conductor and ground, due to the flashover of an insulator string or other line trouble, is correctly indicated to the relays.

Briefly, the function of the compensation scheme is to provide for the relays an accurate indication of line voltage without the use of high-tension potential transformers. It is used to avoid the expense and hazard of such transformers.

13-Kv. Scheme

Impedance-relays supplied with voltage from 13-kv. potential transformers and without compensation are used on three of the 13-kv. feeders. These particular feeders form a loop supplying three distribution substations in Denver. These relays operate in conjunction with other relays in the substations and are expected to give more rapid sectionalization of this loop during line troubles than could be obtained with the usual directional-overload relay equipment.

A somewhat unusual use is made of the inverse-time voltage characteristic of these impedance relays for protecting two parallel feeders. If straight overload relays were used very heavy settings would be required to prevent the second line from tripping after the failure of one of the lines. With the impedance-relays there is no definite current-time setting, thus daily and seasonal loads and capacities are cared for automatically. In the summer the hydro plants are used to supply the entire system during the light-load periods. Under this operating condition the short-circuit current at the substation is so light that at best only very slow operation of overload relays could be secured. However, the drop in voltage due to feeder trouble is correspondingly great and serves to increase the operating speed of the impedance relays. Thus it is possible to clear circuits in trouble with only the normal time delay.

Relay operation on the 90-kv. loop has been 95 per cent correct to date. The incorrect operations were double operations occasioned by surges of synchronous equipment upon the clearance of a heavy and close-in short circuit. This difficulty was overcome by the installation of time-delay relays which block the second breaker for 15 seconds after the operation of the first.

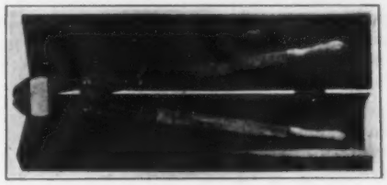
Northwest Construction

66-kv. transmission line of the Northwestern Electric Company approaching Albina substation along Fremont Street, Portland, Ore. 11-kv., high-line telephone and 220-volt secondary lines are carried on the same pole.

Rubber Insulated Wire Cutter Is Safer Tool to Use

By A. KANEKEBERG, Electric Distribution Department, Public Service Company of Colorado, Denver.

The long, bare metal handles of the usual wire cutter constitute a hazard of dangerous proportions as is witnessed by the number of accidents traceable to them. To provide a safer tool the safety and claim department of the Public Service Company of Colorado has designed a rubber insulating sleeve to cover wire-cutter handles as shown in the accompanying illustration. This safety feature is manufactured by the Gates Rubber Company of Denver under the department's specifications and withstands a 30-kv. test. To protect this style of cutter from damage to insulation a special reinforced and



Safety wire cutter.

padded box is provided as a transporting container for each cutter.

The partciular accident that prompted the development of this safety feature was a short circuit caused by the metal handles of a cutter.

Enameled Insignia Proves More Economical Than Stenciled

A type of insignia that has proved an item of great economy to the Key System Transit Co. of Oakland, Calif., is shown in the accompanying illustration. Instead of painting its insignia upon cars and buses the company is using a steel shield enameled in color. The design is cut in ⅛-in. enameling steel and the enamel finish is baked on in an electric oven.

The insignia is practically indestructible in its normal use on cars and buses and effects an appreciable saving in the long run because it does not have to be repainted from time to time as do the painted or stenciled insignia. When cars or buses go into the paint shop the plate is easy to remove and as readily replaced as the job may require.

Enameled plate used on cars and buses.

Analysis of Current Transformer Tests—I

Simplified Discussion of Vectors and Their Application to Current-Transformer Problems to Follow

By E. C. GOODALE, Puget Sound Power & Light Company, Tacoma, Wash.

Since the current transformer is in all respects the mainstay of the watt-hour meter and the induction relay, a thorough understanding of its operation in a circuit will be of inestimable value in figuring the solution to metering or relay problems. Also, since the action of groups of current transformers hardly can be shown without the use of vectors, any discussion on current transformers logically should be preceded by a short explanation of the meaning of vectors and their application to the solution of current transformer connection problems. To those already well acquainted with vector problems and their graphical solution the following problems perhaps will be of little interest. It is for the practical meterman or relay man that they are taken up.

Vectors

A vector is the graphical representation of a force or quantity having both magnitude (quantity) and direction. A vector usually is drawn in the form of an arrow the point of which indicates the direction of the quantity so represented and the length of which indicates or is proportional to the magnitude so represented. Vectors may be and are used for the graphical representation of many different quantities.

In a.c. electricity the vectors used indicate, and the length of the vector is proportional to, the voltage, current, or flux so indicated and the angle of the vector with reference to the others indicates directly the time-phase relation of the indicated quantity with reference to the others. In other words, the direction of any vector with reference to the direction of any other vector indicates directly the relative times at which the indicated quantities are as shown in the wiring diagram of the circuit under study.

In order to use vectors effectively it is desirable that a connection diagram be drawn, fully labeled and marked with direction arrows on all branches indicating the voltage and showing direction of current flow, etc. These may be in either direction desired, but preferably pointing from source to load, the most natural direction for them to point. The lengths in the vectors then will show the effective values in the various parts of the circuit and the angle between the vectors will show the relative times at which they will flow at a maximum in the directions indicated on the connection diagram.

Take the case of the primary currents on a 3-phase line as shown in Fig. 1, supplying a balanced 3-phase load, the directions of the currents being assumed from a source at the left to a load at the right. It is a well-known fact, easily proved by attaching equal pure-resistance loads across each phase

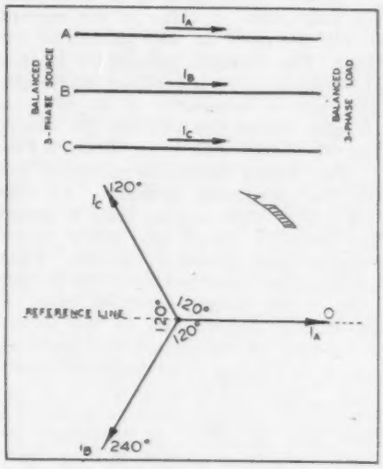


Fig. 1. Schematic circuit diagram (above) and vector diagram (below) showing 3-phase balanced conditions.

and then totalizing the currents in the phases to make the line currents, that these line currents, assumed as going from a source to a load as shown may be represented by three vectors 120 deg. apart. This 120-deg. angle corresponds to ⅓-cycle or, for a 60-cycle circuit, ⅓ x 60 or 1/180 of a second. (See Fig. 1.)

In other words, 120 deg. or 1/180 sec. after the current I_A is flowing in line "A" at a maximum and in the direction shown the current I_B will flow in line "B" at a maximum and in the direction shown. Also, 1/180 sec. later still, cur-

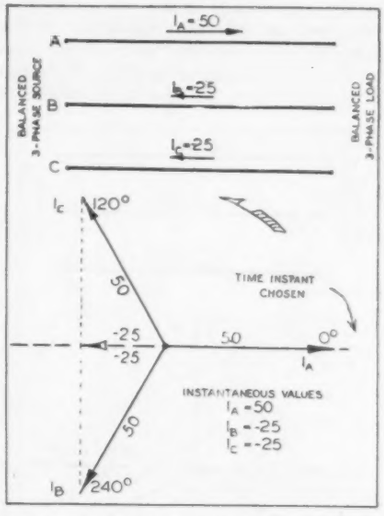


Fig. 2. Schematic circuit diagram (above) and vector diagram (below) for the instant at which current I_A is at a positive maximum in a balanced circuit. Projection of current vectors I_B and I_C onto the horizontal zero reference line gives a measure of their instantaneous values, —25 in this case.

rent I_C will be flowing in line "C" in the direction shown and at a maximum; and, 1/180 sec. after that I_A again will be a maximum in the direction indicated.

Example

Suppose it be desired to determine the magnitude or value of the current in all the lines at any particular instant. For example, assume the instant at which I_A is at a positive maximum. All that is necessary is to draw a straight dotted line through the center and "in phase" with I_A as shown in Fig. 2. This dotted line is the reference line for this particular problem. To this line and at right angles draw a dotted line from the tip of any vector whose value at that instant is desired. Then the distance from the center out to that point is the desired effective value of the current represented by the vector in question at the instant that the current I_A is flowing at a "positive" maximum. For vector purposes it is assumed that current indicated as flowing from left to right is "positive" or "plus," and that current flowing from right to left is "negative" or "minus." If, as in Fig. 2, these "projections" point in the opposite direction from that of the reference vector or time-instant under consideration they are negative by that amount. If they point in the same direction they are positive.

For example: If the line currents at maximum values were 50 amp., then, at the instant of time shown in Fig. 2 there would be 50 amp. going from 3-phase source to load over line "A" and 25 amp. coming back in line "B" and 25 in line "C." This is quite reasonable since at any instant the current that goes down to the load must equal that returning to the source.

This same procedure may be followed to find the values at any particular instant desired for all quantities correctly represented on the one connection diagram and the corresponding vector diagram, whether they be voltages currents, ampere-turns, or flux. If, when projected down to the time-reference vector in question the resultant vectors are pointing in the same direction as the time-reference vector they are positive at that instant and hence flowing in the direction assumed on the connection diagram. Their values will correspond to the lengths of the projections along the reference line according to the scale chosen.

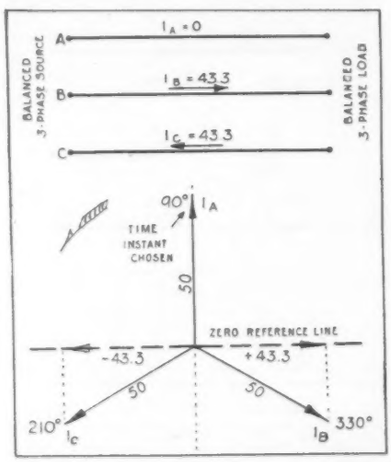


Fig. 3. Schematic circuit diagram (above) and vector diagram (below) showing conditions existing in the circuit of Fig. 2 ¼-cycle or 90 deg. later than the instant indicated in Fig. 2.

In plotting vectors all voltages must be to the same scale, all currents to the same scale, etc., although of course any scale may be chosen for the voltages and the same or any other scale for the currents, depending upon their values, the size of the paper and the arrangement desired.

Further to illustrate the preceding, assume an instant about 90 deg. (¼-cycle or 1/240 sec. for 60 cycles) after I_A came to a maximum in the direction indicated in Fig. 2. This condition is illustrated in Fig. 3, both in vectors and in corresponding instantaneous circuit diagram, where it may be noted that vectors I_A, I_B and I_C have rotated 90 deg. clockwise from the position shown in Fig. 2. At the instant shown there would be 43.3 amp. going down line "B" and 43.3 amp. returning over line "C" to the source. The designation of these values would be + 43.3 and — 43.3, respectively, the signs indicating instantaneous direction of flow.

This "projecting" procedure is necessary only when it is desired to find instantaneous values; that is, values at any particular instant. An ammeter connected in series in any of the lines in the preceding case would register the effective value:

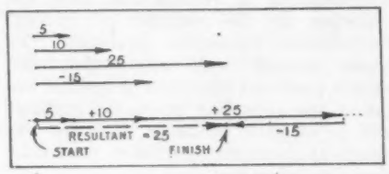


Fig. 4. Scheme of adding and subtracting numerical values indicated by linear vectors.

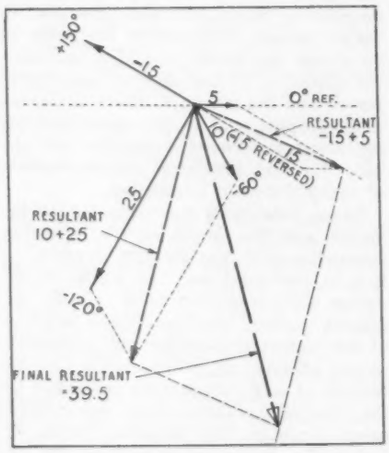


Fig. 5. Vector addition of numerical values indicated in Fig. 4, but which now are considered to be acting at various "phase" angles as shown. The common-origin parallelogram system of construction and combination is used. Compare with the polygon method shown in Fig. 6.

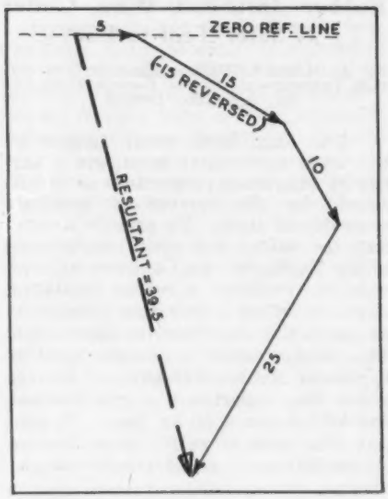


Fig. 6. Polygon method of solution of the problem of Fig. 5. This method is less confusing for straight addition or subtraction of vectorial quantities.

$$\frac{50 \text{ (max.)}}{1.414} = 35.35 \text{ amp.}$$

In other words, to produce the same effect on an ammeter capable of registering correctly either a.c. or d.c. it takes an alternating current whose maximum value (for pure sine waves) is 1.414 times the value of the d.c. It is this equivalent d.c. value which standard a.c. ammeters and voltmeters register.

Addition and Subtraction of Vectors

Just as numerical values may be added and subtracted, so vectors may be added and subtracted. For example, assume a scale of 20 amp. per in. and suppose it were desired to add 5 amp., 10 amp., 25 amp., and from the total to subtract 15 amp., all the currents being "in phase," i.e., coming to a maximum at the same instant. It easily could be done as shown in Fig. 4. Simply add the lengths, heel and toe, **reversing direction for a subtraction.** The result would be obtained by drawing a vector from the start to the finish point, its length corresponding to the value of the sum: $5 + 10 + 25 - 15 = 25$ amp.

This way of doing the addition and subtraction graphically is not peculiar to quantities all of which are in phase. The same method may be applied to vectors having phase differences as shown in Fig. 5. With these same numerical values at the phase or time angles shown in Fig. 5 it may be seen that the resultant is not 25 as before, but in this particular case comes out approximately 39.5. Here, too, all that is necessary to subtract a vector is to reverse its direction and add. This is indicated in the case of vector "—15" at 150 deg. which enters the solution diagram as vector 15 at —30 deg. The resultant obtained in this manner is the

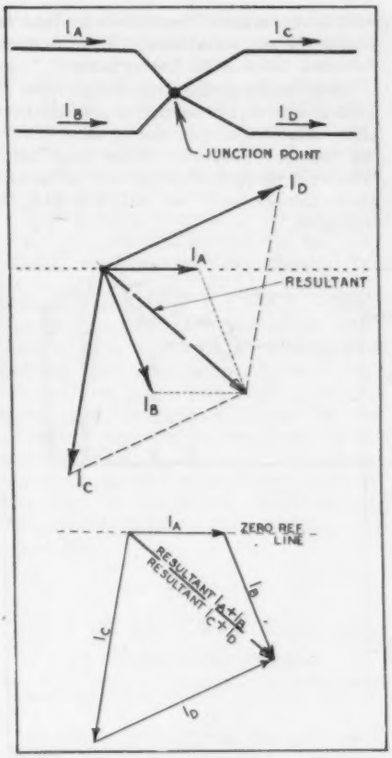


Fig. 7. Schematic indication of 4-way current junction point (above). Vector diagram of current at junction point as assumed for this example is shown in heavy solid lines (center), the dotted lines indicating the parallelogram method of proving that sum of currents entering junction is equal to sum of currents leaving junction. Below is shown the polygon method of solution for comparison.

true resultant both in magnitude and direction and the parts going to make it up will, at any instant of time, total up to give its value at that instant.

The vector system mentioned in the foregoing paragraph and illustrated in Fig 5 is known as the common-origin parallelogram method. That is, all major values are indicated by vectors radiating at the proper angles from a common point. This system is the one in most common use in electrical problems and affords certain possibilities not otherwise easily attainable, as will be brought out in subsequent discussions.

Polygon System of Vector Addition

For the addition and subtraction of vectorial quantities it is recommended that the so-called "polygon" system common to civil and mechanical engineering be employed. It is simple to understand and the resulting diagram is much less confused by a multiplicity of lines. This system also is known as the "heel-and-toe" method, deriving its name from the method of procedure wherein the diagram is built up by successively placing the heel of one vector at the toe of the preceding and thus progressing until all of the vector quantities are cared for. Then the resultant is represented by the vector which closes the remaining open side of the polygon so formed.

As an example Fig. 6 shows the same vector quantities considered in Fig. 5, but combined by the polygon system. The values in the key diagram are transferred to the polygon diagram one by one, starting with any vector and progressing consecutively until all are transferred. In Fig. 6 vector 5 is chosen as the starting point because its direction corresponds with the zero reference line. Other vectors are used in turn as shown.

Kirchoff's Current Law

Kirchoff's current law is the law most intimately connected with the solution of current-transformer problems. A modification of Kirchoff's current law informs that:

Any current flowing toward any junction point in an electrical system is equal to the total current leaving that junction minus any other currents flowing toward the junction.

The law itself states that:

The sum of the currents coming up to the junction point equals the sum of those leaving.

For example, in the network diagram shown in Fig. 7 the sum of I_A+I_B must equal, vectorially of course, I_C+I_D. The

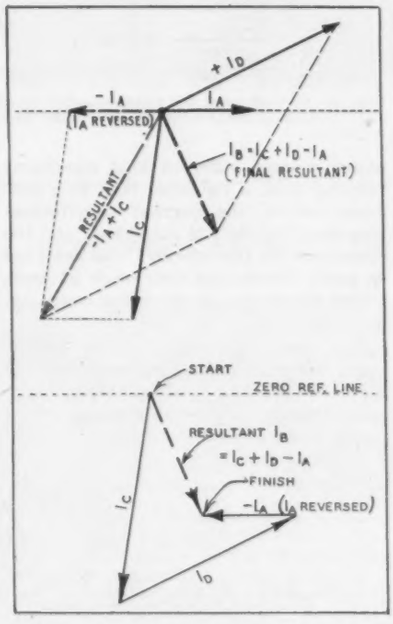


Fig. 8. Vectorial methods of determining an unknown current in the example of Fig. 7 when three of the current values are known. Parallelogram method (above) and polygon method (below).

vectors shown agree with the circuit diagram and represent one of the many possible current combinations that could be selected to illustrate this particular point. The fact that $I_A+I_B=I_C+I_D$ is proved by the fact that the resultant vector obtained by the combination of I_A and I_B is the same as that obtained by the combination of I_C and I_D.

Suppose I_B were not known but I_A, I_C, and I_D were known. I_B could be found by the modification of Kirchoff's law, as stated above. That is, I_B should equal $I_C+I_D-I_A$. A similar modification will hold in determining the current leaving:

The current leaving a junction point in any conductor equals the total current entering, minus any other currents leaving the junction.

Suppose I_D were not known and all other values were known. Then I_D should be equal to $I_A+I_B-I_C$. These two examples are illustrated in Figs. 8 and 9, respectively. In Figs 7, 8 and 9 are shown both styles of vector diagrams, each arriving at the same result, but the polygon system being less involved.

These few simple facts form the background upon which may be built up a good working knowledge of vectors and their application to the solution of metering and relay problems. To understand these principles better it is well to work out a number of vector problems. First make a connection or circuit diagram and then a vector diagram that will suit the connection, such as shown in Fig. 7, and from this work the additions and subtractions as in Figs. 7, 8 and 9.

The greatest difficulty may be experienced in getting a suitable arrangement of vectors to fit a given connection scheme. This difficulty can be simpified by drawing a figure similar to the vector diagram of Fig. 7 at the start. That is, draw the "resultant" first. Then draw in the other broken lines from start to finish in any order desired, as long as they agree with the circuit diagram. This will give a set of vectors with which to work and which will be correct as to length and phase angle and always will check correctly with the connection diagram. A little practice will improve greatly the user's understanding of vectors.

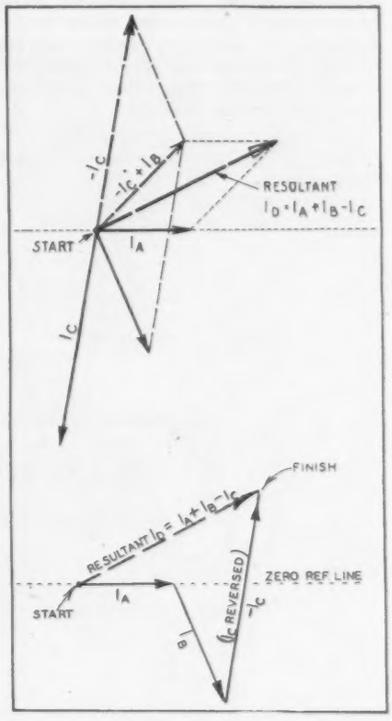


Fig. 9. Vectorial methods of determining an unknown current in the example of Fig. 7 when three of the current values are known. Parallelogram method (above) and polygon method (below).

Multiple-Connected Current Transformers Improve Circuit Relay Protection

By F. E. DELLINGER, Overhead Electrical Engineer, Los Angeles Gas & Electric Corporation, Los Angeles

A double-bus system for the control of primary circuits is standard design for distribution substations of the Los Angeles Gas & Electric Corporation. This scheme requires two oil circuit breakers per circuit with disconnecting switch on both sides of each breaker.

In the earlier substations one set of current transformers was used to serve the ammeters and overload relays. These current transformers were located at the point where the circuit left the building thus giving no relay protection should a short circuit occur in the regulators or wiring inside of the substation.

To correct this fault use is made of two sets of current transformers, connecting one set in the circuit between the regulator bus and its associated circuit breaker and one set in the circuit between the auxiliary bus and its associated circuit breaker. The secondary windings of the two sets of current transformers are connected in multiple to one set of ammeters and overload relays as shown in Fig. 1. This connection furnishes overload protection to the regulators as well as to the circuit and also gives an indication of any excessive exchange of current when paralleling the circuit on the regular and auxiliary buses.

Before adopting the use of multiple-connected current transformers a series of laboratory tests were made to determine the accuracy under varying conditions of load and power factor. No appreciable error was found under the most unfavorable condition.

Connections used in these tests are shown in Fig. 2. The current transformer in the main circuit was of 10-amp. capacity and the current transformers in the multiple circuits were of 5-amp. capacity each. Tests were made under several different load conditions varying from a balanced load to a condition where one current transformer was carrying its full rated load and the other current transformer was carrying no load. Tests also were made at loads where the power factors were badly unbalanced.

The meter committee of the Pacific Coast Electrical Association of 1923-24 reported after a series of elaborate tests that no appreciable error would result in the multiple connection of current transformers regardless of load or power-factor unbalance. This further justified the use of the scheme.

After making the first installation in 1924 a series of tests under actual operating conditions was made, each showing perfect results. Since that time 100-per-cent-perfect relay operation has been experienced on all circuits so equipped.

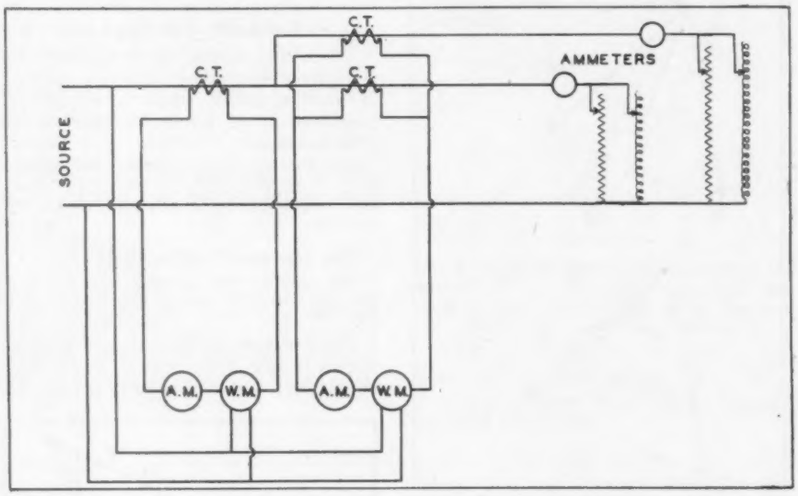


Fig. 2. Circuit used for experimental investigation of operating characteristics of meters and relays served by single and by paralleled current transformers.

Synchronizing Problem Solved by 30-deg. Phase Shift

Synchronizing difficulties at one of the plants of The Washington Water Power Company were overcome in the method indicated in the accompanying illustration. The troublous condition came about at the time that a new 110-kv. transmission line was tied into the plant in question. Due to potential connections as they existed, a 30-deg. phase difference existed between the secondary of the 110-kv. potential transformers and the secondary of the 4-kv. potential transformers on the generator bus.

To have synchronized between the buses under this condition would have necessitated the closing of the oil circuit breaker with the syncroscope

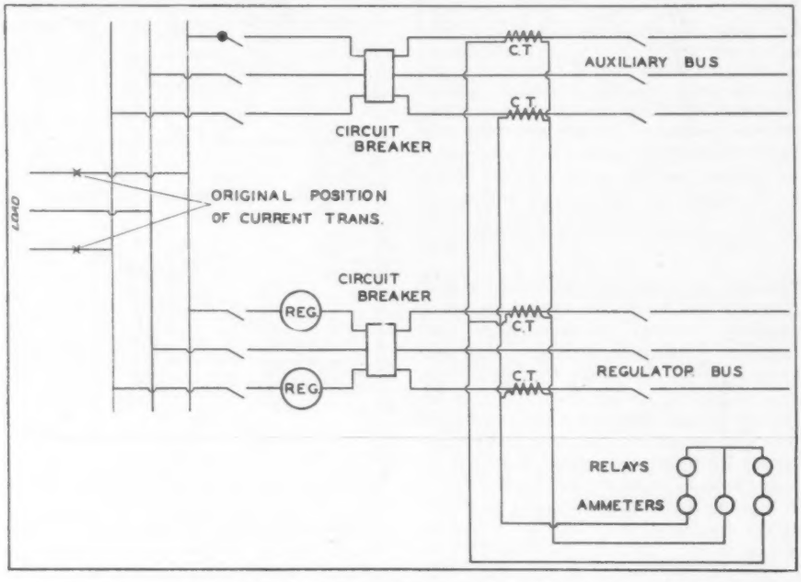
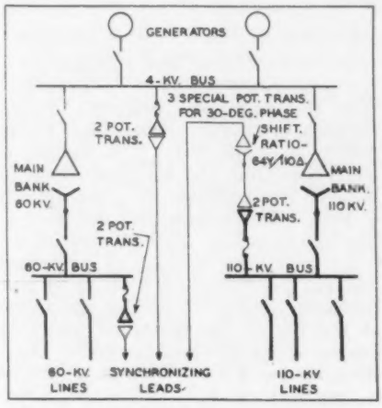


Fig. 1. Scheme of primary circuit protection adopted by Los Angeles Gas & Electric Corporation.



Schematic diagram showing method of effecting 30-deg. phase shift in 110-kv. potential leads of synchroscope.

pointer indicating 30 deg. from the vertical position. Such a system would have been greatly confusing and undesirable under normal circumstances and doubly so because in synchronizing between the 60-kv. and the 4-kv. buses a truly synchronous condition existed when the syncroscope pointer indicated zero position.

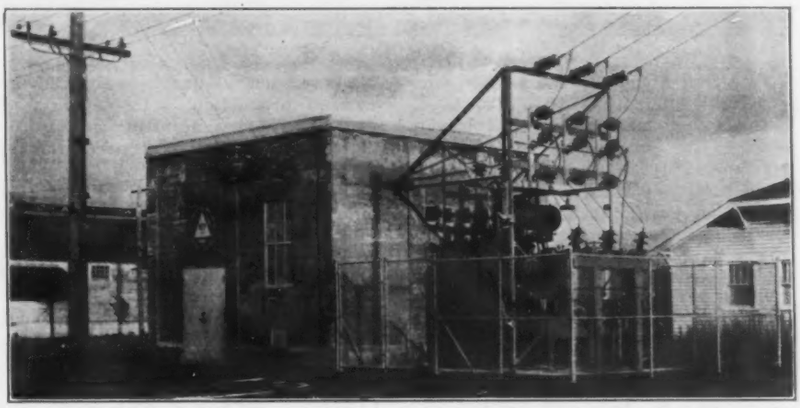
To effect the necessary 30-deg. shift in the syncroscope leads from the 110-kv. bus a set of Y-delta-connected potential transformers was placed in the secondary circuit of the 110-kv. potential transformers as shown in the illustration. The net ratio of transformation of this set of transformers was 1/1, but the desired phase shift was accomplished, permitting closure of the oil circuit breaker between the 110-kv. and the 4-kv. buses with the syncroscope pointer in a normal zero position. The cost of the extra set of potential transformers involved was only about $60.

Indoor 22 and 2.4-kv. Equipment at Beaverton, Oregon

By W. C. FOSTER, Assistant Operating Engineer, Portland Electric Power Company

In the accompanying illustration is shown the new Beaverton substation of the Portland Electric power Company at Beaverton, Ore. This substation was placed in operation Nov. 28, 1926, serving the Tualatin district and replacing the original substation which burned down May 26, 1926. During the interim between May and November an emergency substation was in service as described on page 306 of the Oct. 15, 1926, issue of the Journal of Electricity.

This station is built in two major units as indicated. The outdoor unit comprises a 1,500-kva. 57/22-kv., 3-phase transformer and its oil circuit breaker and disconnecting switches. A concrete building houses the second unit which includes the 22-kv. and 2.4-kv. equipment. The 22-kv. bus feeds one outgoing 22-kv. line serving outlying towns in the Tualatin Valley. Interruptions are cared for by an automatic reclosing oil circuit breaker. The 2.4-kv. service for local distribution is supplied through an automatic reclosing breaker from a bank of three 120-kva. 22/2.4-kv. transformers. No circuit breaker is provided between these transformers and the 22-kv. bus, protection being afforded to the former by S. & C. fuses. The entire cost of the building and equipment was about $20,000.



Substation of Portland Electric Power Company at Beaverton, Ore.; 57 kv. incoming, 22 and 2.4 kv. outgoing.

A Combined Power and Lumber Project in Idaho

Status of the Lewiston development of the Inland Power & Light Company on the Clearwater River as of Jan. 8, 1927. This view shows the dam that will divert the river into a large forebay created by the erection of some 7,000 ft. of dike. The dam is to be fitted with two 30-ft. taintor gates, three 18½-ft. roller gates of 105-ft. span, and four 105-ft. needlebeam gates to pass 200,000 sec.-ft. under flood conditions and still maintain the normal 20-35-ft. operating head.

Ideas for the Contractor

Good Cannery Lighting Proves Its Case

Careful Study of Canning Problems Results in Lighting Installation Delivering from Twenty to Twenty-five Foot Candles

By KENNETH S. RITCHIE, formerly Illuminating Engineer, Pacific Gas and Electric Company.

IMAGINE a cannery illuminated with a light intensity of from 20 to 25 foot-candles. Unbelievable as this may seem to the practical illumination engineer yet at the new plant of the United States Products Corporation at San Jose, Calif., such an installation has been in actual use daily for the larger part of the 1926 operating season. Speaking for the management, President D. C. Kok states: "The light is wonderful. I have never seen anything like it before. It is better than daylight. In fact, over some of the canning tables we have found it profitable to burn the lights all day to break up the shadows from the shelves. You see the skylights are in the wrong place for some of the tables. With the lights on, the workers can see better and work faster."

For the benefit of fellow engineers, the writer is describing here the results of his experience in devising a very practical cannery lighting installation. This article will contain part of the sales talk used in selling better lighting to the management, and details of the illumination principles applied to the conditions peculiar to canneries.

Most cannery managers have neglected to install good lighting in their plants because they feel it is only an additional expense not warranted by the seasonal operation of the plant. Few superintendents have stopped to figure the actual benefits to be realized from good lighting and the low cost of obtaining such desirable results. Increased production, better quality of work, and fewer accidents are all reflected in the improved morale of the workers.

The ultimate aim of all good factory lighting is to make night operation just

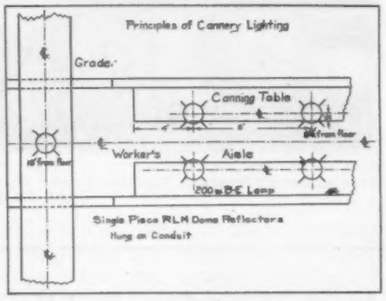


Fig. 3. Detailed drawing showing location of units over canning tables.

as successful as daytime operation, that is to maintain a uniform hourly productive output per worker. In the seasonal operation of canneries, night work plays a very important part in the packing of perishable fruits. Some of the operations in the canning process require as much work with the eyes as with the hands. Here each worker's production is directly dependent upon the quickness of seeing details, his "speed of vision" or "seeing power." Good lighting is in reality a working tool, an aid to the physical and mental condition of the operators. For any lack of good lighting the management pays heavily in slower production and poorer quality of work resulting from the discomfort due to eye strain and brain fatigue. This is especially true at the end of the day. It is not difficult to compute very easily the possible saving if only a half an hour of over-time can be saved each day.

Study of Plant Operations

In designing this installation, a detailed study of the various operations in the canning process were made in order to determine the requirements for correct lighting. Two general objects were kept in mind during the preparation of the detailed layout. First, the light for each operation had to be of sufficient intensity so that workers could see details as quickly as in daylight. Second, glare, caused by bare unshaded lamps and scintillating reflections from the highly polished cans, as well as sharp directional shadows, had to be eliminated in order to reduce one of the primary causes of eye strain and fatigue.

Briefly, the principal areas in a cannery to be considered from an illumination viewpoint are essentially the same as those of the canning process. These areas are named according to their sequence in handling the fruit, as for example: receiving area; preparation or cutting area; the peach slicing

Fig. 1. General lighting for preparation tables. Note how clearly even printing may be seen under this intensity of illumination.

Fig. 2. An intensity of 22 foot-candles is provided at the canning tables to enable operators to select fruit for canning.

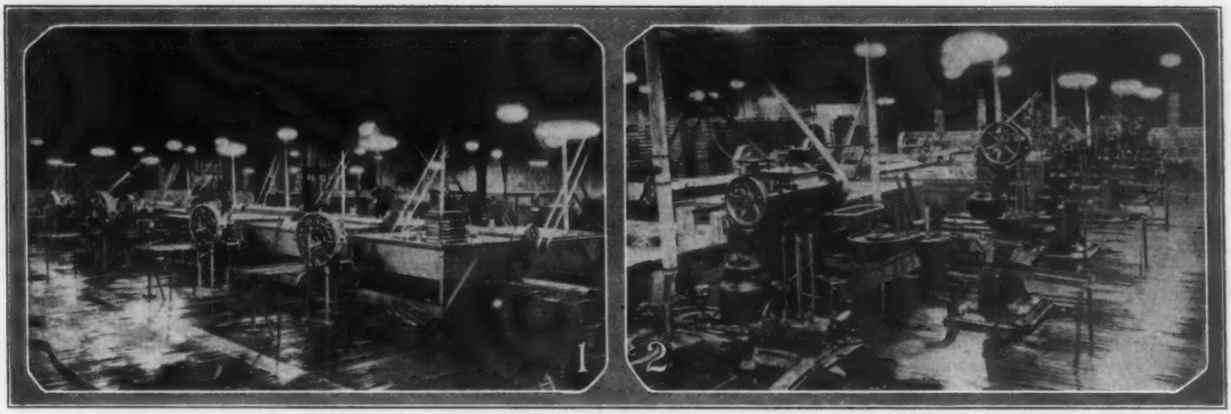


Fig. 4. Localized general lighting at sirupers. Every detail of machines and product may be clearly seen under this illumination.

Fig. 6. Both the horizontal and vertical planes are successfully illuminated under the carefully placed units at the seamers.

machines; the peach scalder; the grader; the canning tables; the cook lines, consisting of sirupers, exhaust boxes, seamers, cookers and coolers; the cooling platform and the warehouse. Only those areas where special features of illumination design were applied will be described here.

With several hundred women working side by side peeling and pitting the fruit it was highly essential that the light be bright uniformly over the entire area devoted to this operation. General lighting was used here as shown in Fig. 1. It was important that the workers detect blemishes quickly and still work rapidly, for they are usually paid by piece work. The tendency would be to sacrifice quality to speed in order to receive as much as possible as the day's pay.

As it was installed the lighting is an example of what may be accomplished by working out a harmonious combination of the proved principles of modern illumination. The use of 200-watt bowl-enamel lamps shaded by standard Benjamin RLM dome reflectors spaced on 10'x15' centers (10'x10' centers would have been better), mounted 10' above the floor, give a very effective distribution of light on the working plane of the table tops. Obviously, one worker is not working in the shadow cast by her neighbor. Both cannery workers and managers in this case were favorably impressed by the lack of the usual spotty, glaring light from bare unshaded lamps and hit-and-miss spacing which ordinarily causes sharp, objectionable shadows.

Selection of Fruit

The most important hand operation in the cannery is the packing of the fruit into cans. The work done at the canning tables is really the heart of the canning process and as such demands the best lighting. Due to the construction of the tables the direction of the light from lighting units is a very important factor. Fig. 2 shows the lighting at the canning tables and Fig. 3 a detail drawing of the location of lighting units.

By placing a row of lights directly over each table on a center line six inches inside the front edge of the tables and by spacing the units on 8-ft. centers at a height of eight and one-half feet from the floor, a uniform distribution of brightly diffused light was obtained free from interfering shadows of workers and shelves and free also from the irritating reflections coming from the drops of water on the wet fruit and cans.

Here the final grading of the fruit is done as it goes into the cans and the seeing power of tired workers is greatly aided by the 22 foot-candles of light resulting from this installation. There is less likelihood of there being sloppy, careless work while the workers try to keep up their hourly productive output at over-time piece rates after the regular eight hours. The bright light is a stimulus for good work as eye strain and general fatigue are greatly lessened by the ability to see after dark as well as in daylight without strain. In fact, electric light is used during the daytime at several of the tables to break up the objectionable shadows from the shelves.

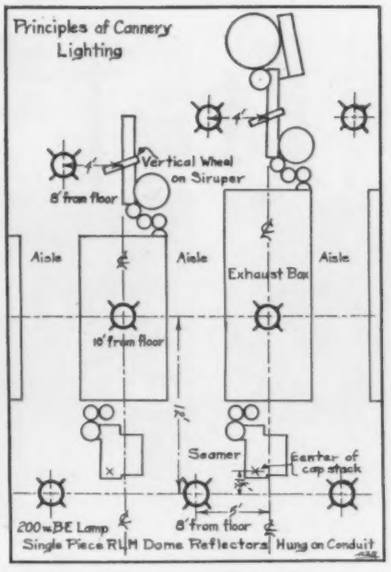


Fig. 5. Drawing showing location of units for sirupers and seamers.

It will be noticed in Fig. 3 that the placing of a lighting unit at each end of the aisle eliminates one reflector. The management appreciates this little point of economy in the lighting layout.

The most suitable lighting at the sirupers was found to be that coming over the right shoulder of the operator loading the cans into the machine. Fig. 4 shows the even distribution of well-diffused light at each machine and Fig. 5 shows the detail plan for the locating of each unit. The units are mounted 8 ft. from the floor and 4 ft. back from the center of the vertical wheel. The result is that light falls on the loading plane primarily from two sources, the unit behind the operator and the unit at the siruper in front of him. This plan eliminated the annoying and dazzling reflections from wet, shiny surfaces of moving cans and still made it possible to have plenty of light low enough to see the cans passing under the sirup reservoir. A light intensity of 10 foot-candles made for an effective visibility at this station.

Lighting for the various sections of the cook lines was designed to make all parts of the machinery readily visible at night. Proper location of the units over the exhaust boxes (see Fig. 5) made it possible to illuminate not only the aisles but also the insides of the open boxes. Likewise, careful planning of light placement at the cookers and coolers produced a similar result. Here the units were located over the aisles instead of over the cookers because the accessible portion of the machinery faces the aisles. The two-point or multiple-source principle of localized general lighting was followed always.

One more particular piece of special illumination designing is illustrated in Figs. 5 and 6. The lighting requirements at the seamers called for well-diffused light coming from sources so placed as to reduce to a minimum the tiresome gleam from the shiny surfaces of the cans moving in monotonous rapidity through the machine. Likewise the plane directly under the capper must readily be visible so that the operator may prevent a jamming of the cans during operation. That these requirements were met successfully may

be seen in the photograph. There is a lack of intense reflections on the seamer and there is an even distribution of light for the entire row of machines. The chances for serious accident to this station are greatly reduced, the operator being able to see detail so much more easily in a well-lighted area.

Standardize on Lamps

Another item was taken into consideration in this installation. In order to be certain that the correct size of lamps always would be used, it was decided to standardize on 200-watt bowl-enemel lamps for all lighting units in the cannery. This requires but one size kept in stock. No matter who relamps a unit, the correct wattage always will be used.

In order to take up vibration and to assure proper maintenance of reflector spacing, all units were hung on conduit suspended from 4-in. outlet boxes containing Benjamin self-aligning fixtures. These boxes were fastened directly to the corrugated sheet-iron roof by an ingenious hook device designed by Contractor Roy M. Butcher, Electragist of San Jose, who made the electrical installation.

This brought the installation within the fire-proof requirements for the building.

The original layout submitted for approval called for 185 lighting units in the canning part of the plant. Emphasis had been placed on the fact that this design was a moderate installation with the minimum number of units placed most effectively to give good lighting. Even the spacing was farther apart, in many instances, than called for by established principles as shown by the spacing and mounting height curves. This helped appreciably in convincing the management that the plan was a reasonable one. Scarcely any mention was made of the foot-candles of light intensity. The lay mind can grasp something measured in terms of a yardstick, so when the salesman tells the prospect that old lighting gives about 3 foot-candles and the new plan in front of him will give 12 foot-candles Mr. Prospect says, "Nothing doing. Six foot-candles will be enough for my plant." In the back of his mind he imagines that he is cutting the first cost in half. Hence it is better sometimes never to mention foot-candles more than casually in the sales talk.

By leaning on the conserservative side in preparing the lighting plan, the prospect when it is presented to him will find it more difficult to reduce the total number of units by saying that any one unit is unnecessary, thereby really destroying the unity of the design. If the prospect becomes too "choosy," the salesman can state flatly that, having prepared a reasonable plan, too many changes will render the plan valueless and the prospect may just as well make up his own plan himself. If he is going to buy fixtures instead of light, then a plan is not needed. Accordingly in this installation only a few minor changes were made, reducing the total number of units only from 185 to 170.

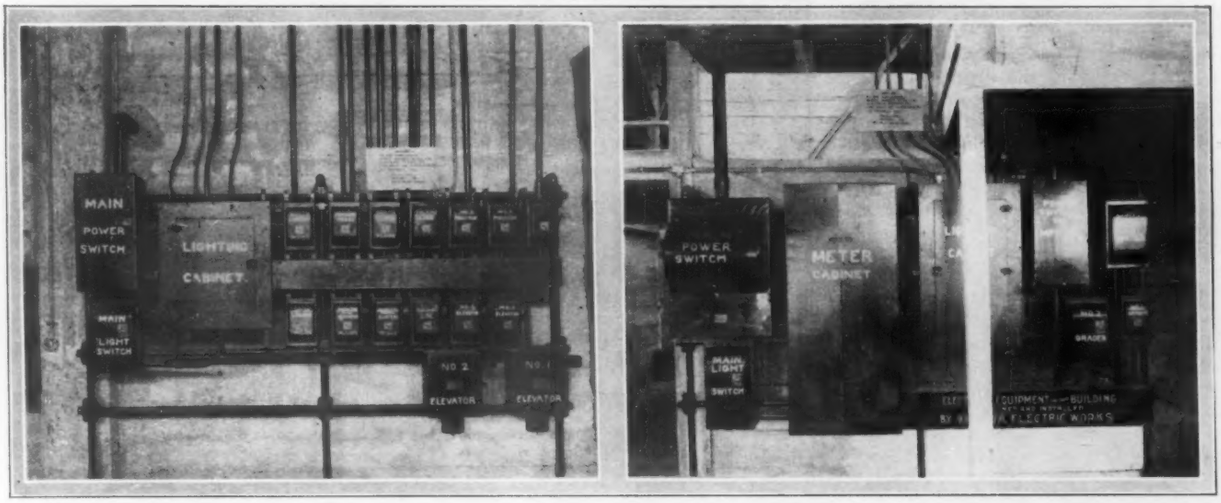
In conclusion, it can be seen that cannery lighting is a rather specialized type of lighting. Those concerned with preparing a layout for a cannery will find that it pays to employ simple principles and standards. In this case these were expressed by the use throughout of 200-watt bowl-enamel lamps; RLM dome reflectors hung either on pipe-stems with fixture aligners in 4-in. outlet boxes or fastened directly to outlet-box covers with shock absorbers in socket bases, and circuits controlled from a switchboard panel. Too much cannot be said about maintaining close co-operation between the contractor and the illumination engineer, for careless work by either will certainly spoil the desired result, namely, correct lighting.

LIGHTING SCHEDULE—U. S. PRODUCTS CORPORATION

Location—Spacing	Mounting Height (from floor) feet	No. Units	Foot-Candles
1. Platforms (elliptical angle reflectors over center of doors)	——	5	—
2. Office—8-ft. centers	8½	2	18
3. Scales—8-ft. centers	8½	2	15
4. Receiving area—15-ft. centers	11	30	4
5. Preparation area—10x15-ft. centers (should be 10x10-ft.)	10	28	6
6. Canning tables	8½	35	22
7. Grader (aisles between tables)	10	3	—
8. Canning table aisles	10	4	—
9. (2) Peach slicers—10-ft. on center line	9	5	—
10. Sirupers	8	8	10
11. Exhaust boxes	10	9	—
12. Seamers	8	9	11
13. Cookers	11	9	6
14. Coolers	11	9	—
15. Cooling platform	10	15	—
16. Scalding room	11	7	—

Uniform Ordinance Advocated.—The National Electrical Manufacturers Association, 30 East 42nd Street, New York City, has printed recently a series of four articles published in Electrical World written by F. L. Nicholson, chairman of the Uniform Code Committee, Electrical Manufacturers' Coun-

Efficient Switchboards Mounted on Piping Made for Packing Plant



Well arranged switchboards fabricated from pipe and fittings as made up by the Visalia Electrical Works for the California Prune and Apricot Growers Association's Visalia plant. This installation contains 20 motors totaling 59 hp. The motors are used to operate grader, processor, loader, elevators and similar equipment. Each of the switches is neatly and plainly labeled and the contractor has left his insignia upon the metal gutter.

sel. The pamphlet contains 30 pages in which the subject is treated from four main points of view. The first division is entitled, "The Need for a Uniform Ordinance," the second, "Why There are Two Electrical Codes," the third, "The Part Played by the American Engineering Standards Committee," and the last, "The Electrical Inspector and the Codes." A number of interesting charts showing the various relationships graphically illustrate the book.

Electricity the Handy Man in Small City Candy-Cafe

Electricity is the general all-'round handyman in the combined bakery, confectionery store, restaurant, ice cream parlor and candy shop known as Bell's Candy Shop, Salinas, Calif. Although completely electrified candy shops and bakeries may be found no doubt in many larger cities this installation in Salinas shows to what extent electrification may be applied to the small shops in cities of from 5,000 to 8,000 population.

For the ice cream section of the candy shop the equipment is particularly complete. An electrically driven ice cream freezer, accompanied by an ice breaker and a mixer for the custard, is located in one section of the shop. Refrigeration is obtained through the shop's own electrically driven refrigeration apparatus nearby.

In the bakery a large size electrically driven mixer for the dough is used and the baking is done in an electric bake oven of 220-volt, 75-amp. capacity.

The kitchen serving the restaurant is equally well equipped. It contains a dish washer and a large steam table which is kept hot electrically.

The additional electrical installation also includes an electrical air heater, drying pump, fan, small oven and an interphone system. The total electrical connected load is approximately 60 kw.

In the case of the particular small restaurant located in a city of this size and serving such a variety of purposes, where help is not always easy to find, electricity is an extraordinarily useful servant and one which the proprietor appreciates.

Simple, Effective Art Gallery Lighting

Modern Gallery of Young Artists Devises Inexpensive Glare-Free, Yet Artistic Lighting Arrangement

By J. R. CRAVATH, Consulting Illuminating Engineer, San Francisco.

The few art galleries which are notably well lighted have usually been so lighted at the expense of considerable expert thought and rather elaborate equipment. Valuable works of art in permanent museums naturally call for expensive fireproof building construction and the best natural and artificial light obtainable. It is not the purpose of this article to describe an elaborate installation of this kind but rather to show the excellent but unpretentious way in which the lighting problem was handled in a new San Francisco exhibit room.

Angle shields protect the eyes from the light source and distribute light evenly over walls and art objects.

The "Modern Gallery" as this exhibit room is called is at 817 Montgomery Street, San Francsico. It is of itself an interesting experiment in the San Francisco art field in that it was recently opened as a co-operative enterprise by a group of the younger artists of the city as a place for the exhibition of the work of its members. The location is near the business district, at a point which was once the center of activities along the city's water front, but is now on the border land of the Italian quarter, and convenient to the studios and workshops of numerous artists.

How Lighting is Accomplished

The room, which was formerly used for a retail store, is about 15 ft. wide, 72 ft. long and 12 ft. high. The daylight factor is practically negligible. The ceiling is nearly white and the walls a light cream color. The lighting equipment consists of four 200-watt lamps in ceiling sockets.

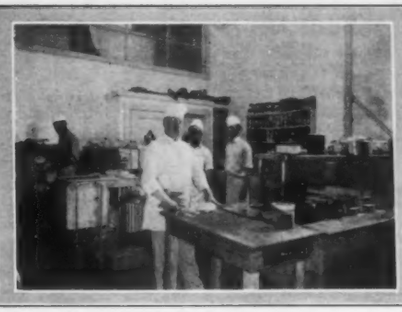
The average lighting specialist probably would have put white diffusing globes around these lamps and let it go at that, thus making a much more glaring as well as a more expensive job than did the artists who were responsible for this. These artists, using materials and methods to which they were accustomed, simply had V-shaped glare shields about 15 in. high, of beaver board, fastened to the ceiling, one on each side of each lamp, so that no lamps are visible to anyone looking the long way of the room. The lamps are too high to be within the field of ordinary vision of any one looking toward the pictures on the walls. Thus the installation is glareless.

Ceiling Effect Artistic

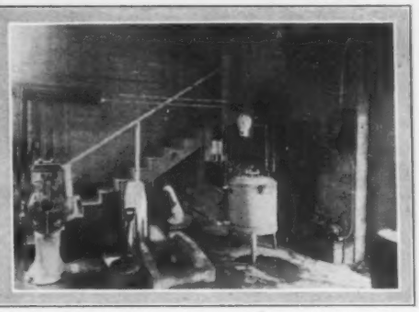
The glare shields are the same color as the ceiling. Of course shadows on the ceiling result, but here the artist comes in again. These shadows cast on the ceiling make a regular design which is pleasing rather than otherwise. The walls where the pictures hang get a good mixture of direct and diffused light of an intensity of about 6 ft. candles. On account of the light color of the walls this results in the gallery having a well lighted appearance even when viewed from the street in bright sunlight through the open door.

As far as the writer knows no lighting equipment on the market in the shape of reflectors or globes would have suited the conditions of this case as well as this simple improvised equipment.

All departments of Bell's cafe, bakery and candy store, Salinas, are connected by intercommunicating phones. An electric oven and dough mixer make the bakery work easy.



In the kitchen for the restaurant the electric dishwasher, shown at extreme left, saves much labor. The electrically heated steam table at right keeps serving foods hot.



The confectionery department is supplied with electrically prepared ice cream by a refrigeration plant, a freezer (left), an ice cracker (center) and a mixer (right). The switchboard is located at right.

Selling the Contractor Himself on the Red Seal Plan

How the California Electragists, Southern Division, Point out to Contractor Members the Essentials and Advantages of the Plan

FIRST link in the chain of the Red Seal idea is the electrical contractor. He is the first to come in contact with its actual conditions and if he is wise the first to profit from the increased standards set up by the plan.

Yet, to convince every electrical contractor that the Red Seal Plan is not "just another of these promotion schemes" but really an industry movement in a forward direction which he would be foolish not to participate in, the California Electragists, Southern Division, have tried out and proved successful a simple lecture plan. Feeling that actual cases are more interesting than mere theory the lecture has been worked up with a set of simple charts giving a typical five room house as an example.

Upon a five room house plan is based the talk on the evolution of house wiring from the "old days," when a wired home consisted of a house into which a number of drop cords had been hung, to the present day standards. The conclusion carries this house on to the future when no home may be considered a good investment or in the least adequate electrically unless it comes at least within Red Seal requirements.

The manner in which the message is carried to the contractors is of particular interest. The following description of the method used to present the idea is in itself one of the strongest Red Seal talking points. According to C. J. Geisbush, executive secretary of the southern division, the Electragists meetings are told of the Red Seal Plan in the following manner:

The meeting is started usually by an explanation of the purpose of the Red Seal Plan, its scope and its objectives. In order that the listeners may get some idea of the rapid increase in the use of electrical conveniences and illumination, the chart labeled 1916 is first exhibited. (Fig. 1). Attention is called to the location of each outlet, the type of fixture used, the wattage per lamp, the few switches and the total absence of convenience outlets and either utility or decorative brackets.

What Is Inadequacy?

When we apply the term to residence wiring, it is best defined with a few examples.

When it is necessary to grope for a switch in a dark room we have electrical inadequacy.

When it is necessary to make use of long, unsightly extension cords in connecting appliances. we have inadequacy.

When it is necessary to attach appliances to bracket or ceiling fixtures, the wiring layout is inadequate.

When a lighting outlet near a stairway is controlled from but one point, we have inadequacy.

When, to use any appliance we must first disconnect some other appliance or remove a lamp bulb, we have inadequacy.

When we attempt to illuminate a major room with bracket lights exclusively (even though there be a dozen) we have inadequacy.

—Electrical League of Utah.

The speaker attempts to call up in the minds of those present the condition existing in the average home in 1916: no electric washers, percolators, toasters, vacuum cleaners, portable lamps, and in only a few cases, an electric iron. This story can be amplified to suit the speaker and his oratorical ability is the only limitation as to how perfect a picture he paints. It is explained also that this job could be installed on one circuit and the total cost of material (knob and tube) would amount to $7.12. (Fig. 1). With ordinarily fast workmen the job could be installed in from three to four hours and could be sold to the owner or contractor for not to exceed $20.

While requesting those present to remember as clearly as possible the 1916 condition the chart is changed to show 1926 requirements for the city of Los Angeles. During this lapse of ten years the local ordinance has determined that a variable minimum wattage be provided for in every room of the house which is wired for illumination; e.g., breakfast nook at least 40, kitchen a minimum of 80, dining room minimum of 200, living room minimum 200, bedrooms 80, bathrooms 80, closets 40, and so on. Switches are demanded by the public on each ceiling light and point is made that somebody has done a job of selling to convince the average home owner and builder that it is absolutely necessary to have a switch on all ceiling lights; in other words the usual argument for the greater convenience offered by wall switches.

Quite some time is spent in identifying the new symbols, those for brackets and convenience outlets. A brief history is given of the convenience outlet campaign started by the California Electrical Bureau, and the following figures are quoted:

"In 1917 there was an average of one-half of one convenience outlet per home, in 1926 there was an average, by actual count, of seven convenience outlets per home."

This represents an increase of some 1400 per cent in the use of convenience

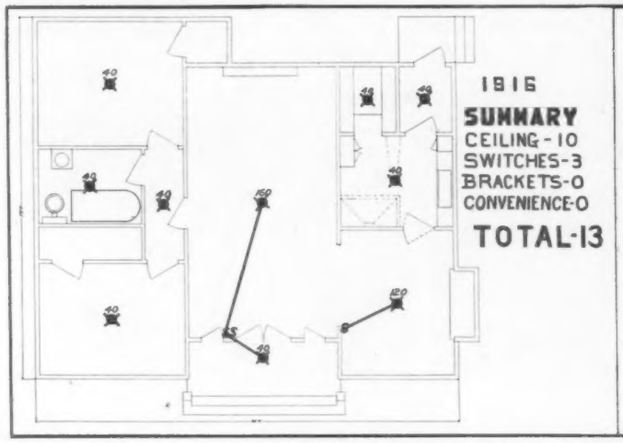


Fig. 1. A typical five room house, as wired in 1916. The chart shows the number and placement of outlets and would have cost $20 to wire under standards of that time.

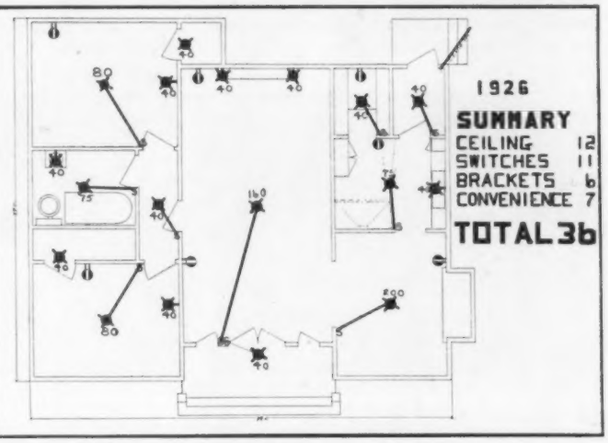


Fig. 2. The same five room house in 1926, with ordinary wiring as required by the advancing standards demanded by the public today. That ordinary job sells for about $150 today.

outlets. Again the fact that somebody has done a selling job is stressed. The same thing has been done with the brackets, both decorative and utility. A typical argument is given on the sale of a utility bracket over the kitchen sink and one over the mirror in the bathroom, and it is pointed out with what ease these brackets can be sold to a housewife or home owner who previously has been denied them.

A comparison is made between the thirty-six outlets at present installed in the average home (Fig. 2) with the thirteen outlets installed in 1916. In fact, the entire argument is based upon this increase in standards which has been going on continuously unaided by any particular interest on the part of the industry (excepting only the convenience outlet campaign). This job would require at least six circuits, the materials for the job would cost $55.34. It would take two men approximately two days to rough in the job and it could not be sold to the public for less than $150. This point is stressed to show the tendency on the part of the public to pay for what it wants and to remove from the minds of the contractors present the idea that electrical work can be only sold on price and not on the greater convenience or service rendered.

Next comes the Red Seal job, in which is pointed out the comparison between the average home for 1926 and the minimum requirements for Red Seal. (Fig. 3). Part of the discussion is devoted to a careful comparison of the requirements as noted on the Red Seal Plan and an effort is made to prove conclusively that the Red Seal standards are not so high after all. The only difficulty thus far encountered has been the sale of the range outlet and this is the way it is attacked:

First, the contractor's attention is called to conditions existing in 1916 and the absolute paucity of electrical conveniences. The speaker traces the gradual increase in the use of these appliances and leaves it to the reason of his audience to decide whether we can expect similar advances in future years. Then going back to 1925, anyone present who can remember a single installation of electrical refrigeration at that time is asked to raise his hand. Almost without exception everybody sits motionless. Then the tremendous increase in the use of electrical refrigeration is compared and the question asked, "Why isn't it reasonable to believe that a similar increase will take place in the use of electrical ranges?"

"Granted," shout the gang. "We believe that electric ranges will eventually be used by the average home owner, but how does that justify the expense of a range service installed now at an expense of $30 or $40 when the range will not be used for some years to come?

Again a comparison is made and this question asked, "Have you ever had a real good customer for whom you have done considerable work and who, incidentally, trusts you implicitly, call you up to a residence and say, 'Mrs. Jones would like to have a convenience outlet installed right here on the base board. Can you do it?' 'Of course,' you answer, and in the course of a few days a man is sent up to install the outlet. Upon beginning the work he discovers that the room is very beautifully decorated and it will require careful manipulation on his part to prevent marring any of the decorations.

"After locating his outlet and preparing his pipe he discovers that the construction of the house is such that it will require three or four times as much conduit as was previously installed to connect with the nearest circuit. On checking up the circuit he finds it already overloaded, carries his investigation still further and discovers that the main service is overloaded and reports back to the shop. The contractor then confers with the home owner and is told to proceed to install the outlet. After several days' work the outlet is installed, the customer is billed for approximately $50 and then the argument starts."

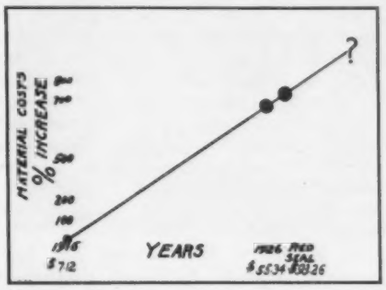


Fig. 4. Chart used to show rising materials cost tendency. The Red Seal wiring is shown to be only in conformity with this general rising trend.

This point usually scores because nearly every contractor has had a similar experience at least once a year and the argument presented is not at all exaggerated. There is one instance on record where the customer paid $400 for the installation of one heater outlet in a bathroom.

"All right," says the speaker, "if this is a usual condition which provokes the ire of the average home owner, wouldn't it be well to apply the same argument to the installation of the range outlet—explain the possible difficulty which will be encountered after the job is completed, etc.?" The contractors to whom this argument has been addressed usually admit that it has its advantages and appear to be willing to try it at least once.

After this discussion attention is called to the material costs on the job which came to $93.26 and with about the same labor as in the 1926 installation. Then are pointed out the increases that have taken place between 1916 and 1926 in costs of materials. Reference to the chart (Fig. 4) will show that these costs increased 670 per cent in the ten-year period or 67 per cent per year, and only a consistent amount between 1926 and Red Seal. Therefore it is seen that the increase is normal.

The meeting is closed with a short discussion on the advantages of the Red Seal Plan, the advertising value during the period of construction, the resale value of the certificate and most of all is stressed the double inspection furnished free by the California Electrical Bureau.

It is the purpose of the California Electragists to develop this chart idea for the explanation of the Red Seal. Possibly another chart may be developed for use in talking to power company representatives in which will be stressed the increase in the wattage between 1916 and 1926. This, of course, will require a hypothetical set of appliances.

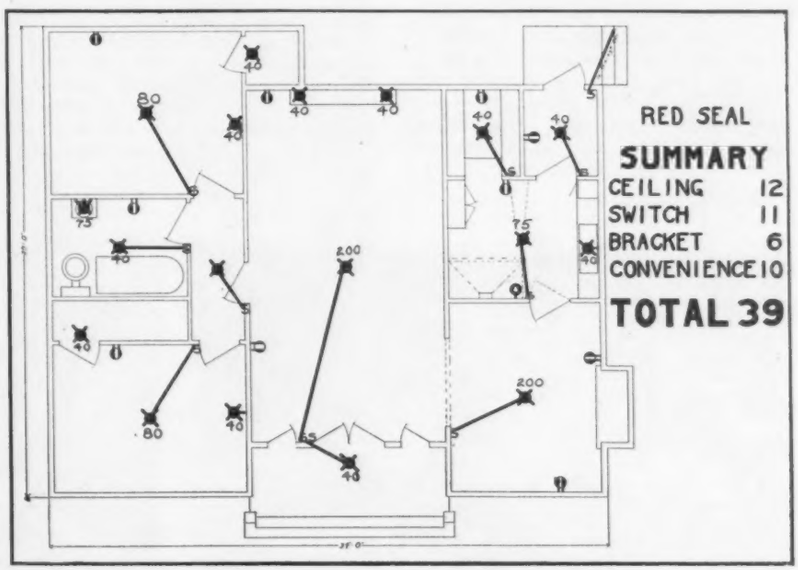


Fig. 3. The same five room house wired Red Seal requires but little to bring it up to the standard and does not add greatly to the wiring cost. However, the adequacy of the home is advanced and with the range outlet the home steps into the class of homes which will be demanded in the future with the greater development of electric range load.

Electric Heat Finds Many Advantageous Uses

In Ceramic, Chemical, Printing and Food Producing Industries or Wherever Accurately Controlled and Clean Heat Is Required Electric Heat Is Preferred

By J. R. WILSON*, Quality Electric Works, Los Angeles

DUE to foreign competition American manufacturers of ceramic products have directed earnest attention to lowering production costs and possible improvements in product. They have found that electric heat provides the logical means of accomplishing both of these objects. Electric heat has contributed almost sensational improvements in the annealing of glass products.

The electric lehr, designed for annealing glass, is a continuous-type oven divided into several heating zones. The length, number and location of these are determined by the product to be treated. With temperature automatically maintained a product of highest quality results.

One prominent manufacturer of glass bottles has obtained wonderful results since the adoption of the electric lehr for his annealing process. One of his customers (a large bottling works) made the extraordinary record of filling and capping 720,000 electrically annealed bottles with a loss of only four from the entire lot.

As previously stated herein, the usual estimated loss is 2 per cent. This bottle manufacturer reports that electricity is no more costly than the fuel he had formerly used and produces a much higher grade of product. His records show that twelve pounds of light weight bottles, or twenty pounds of milk bottles, can be annealed per kilowatt-hour. Over a period of 3½ years the maintenance cost for his first electric lehr was $50.

Firing China

To secure uniform color in the firing of decorated china absolute cleanliness and strict regulation and control of temperature are essential. The use of electric heat for this purpose has proved that absolute uniformity of product can be maintained. Specially designed "box type" electric furnaces are usually employed in this process.

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Electrical Estimating Series—XXI

Vitreous Enameling

Vitreous enameled products, such as bath tubs, sinks, lighting reflectors, cooking utensils, etc., are graded according to the smoothness of the enameling and absence of soot and other impurities. With the old type of fuel fired furnace the attendant danger from dirt and soot resulted in a high percentage of spoilage and consequent rejects. The application of electric heat to this industry has eliminated all of the objectionable features which formerly existed.

A reduction in overhead has been realized, due to increased production per furnace and per man. Frequently the cost of power is greater than the cost of fuel but the overall savings and added market value of the product result in a greater net profit than by the old method. These savings are realized in the smaller plants, as well as in the larger ones. One case in point is that of a maker of butchers' scales. His adoption of electric heat has resulted in a total elimination of his former "rejects," which had amounted to 20 per cent, even though he had to pay 2.7 per kw. for current.

Chemical Industry

In the chemical laboratories, which are usually a part of all large industrial plants, it is essential that the results obtained experimentally, and found to be applicable to the manufacturing process, be duplicated accurately in actual application if the desired results are to be obtained. Where high temperatures and accurate control are necessary electric heat has proved itself ideal for this purpose. The laboratory results can be duplicated exactly in actual practice. The use of vacuum electric furnaces has resulted in the creating of high temperatures otherwise unobtainable.

In the vulcanizing and curing of rubber evenness of heat is essential to obtain successful results. By using immersion units electric heat is employed to create steam, resulting in a single self-contained unit and eliminating all piping. This process has proved very successful in vulcanizing small rubber articles.

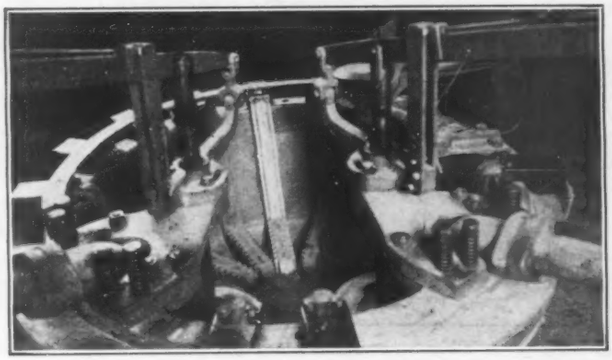
In purifying transformer oil electric heat has proved very profitable for numerous power companies. To separate the carbonized particles which are held in suspension the oil usually is placed in rotating containers. The application of electric heat vaporizes the water and other impurities which the oil may contain. This process leaves the oil in proper condition for re-use and is much more economical and efficient than the old method using fuel heat.

Before the introduction of electric heat the manufacture of graphite was beset with one evil which seemed almost insurmountable — the "crumbling" of electrodes made of this material. Electric heat has resulted in total elimination of the uneven drying due to fuel heat (which was the cause of this trouble), and also results in a much better grade of finished product.

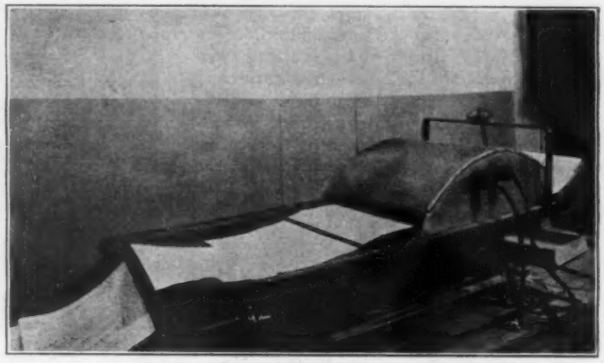
In the manufacture of effervescent salts much difficulty was encountered formerly in driving out all moisture from the product before packing. There was also the danger of contamination, due to the use of fuel heat. By the application of clean, dry heat from electric heaters these products, and others of a like nature, have been improved to such a degree that their purity is now unquestioned.

Printing Industry

It s a literal truth that electric heat has been the means of improving the appearance of typography. To obtain a sharp, clean impression from type,



Five-ton sterotype metal melting pot, equipped with nine immersion units, each 5 kw. Temperature 650 deg. F.



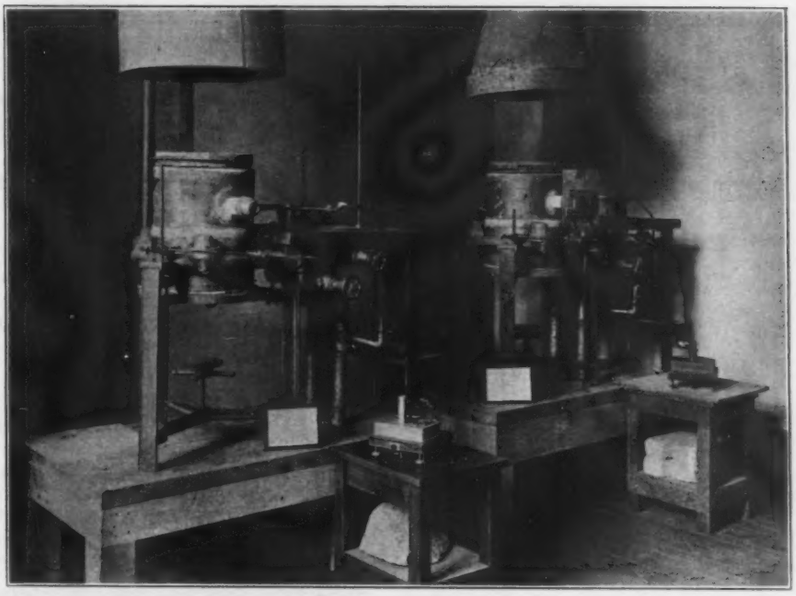
Dryer for printing, also used in the making of processed engraving by the embossing method.

the type metal must not vary beyond a range of 10 to 15 deg. when melted. This applies particularly where a "long run" (a large number of impressions) is to be made. Overheating causes a portion of the tin to be vaporized—producing a residue which is too soft—and the type wears down very fast, resulting in blurred impressions and a great many "rejects."

Underheating results in metal sticking to the matrices, thus producing imperfect type. Both of these conditions have been eliminated since the introduction of electric heat and accurate automatic control. The application of Helicoil sheath wire and other forms of heating units to linotype and monotype machines has done much to improve the printing industry.

The installation of an electric melting pot on any make of typecasting machine almost invariably has resulted in increased production and economy. Due primarily to the fact that the operator's attention is not diverted by the necessity of frequent reading of the thermometer a great many printing firms report increased production of 15 to 25 per cent. A further economy may be realized by the installation of an electric time switch to control the turning on and off of the current before starting and at quitting hours.

The cost of electric heat is frequently less than for gas or other forms of fuel but even where such is not the case the absence of noxious gases and the added cleanliness make for operators who are more content. Due to necessity many printing plants are established in quarters where ventilation is very poor. Quite frequently the only means provided for ventilating the work rooms are open windows. With electric heat full advantage can be taken of this natural ventilation without danger of extinguishing open flames under the melting pots.



Furnaces for making burning tests in assaying samples. One of the chemical uses of electric heat.

Food Industries

Public patronage of bakeries has increased very materially during the past few years, due no doubt to the higher quality of product and also to the growing tendency toward higher standards of hygiene and cleanliness in the modern bakery. The excellence of product and economy (over "home baking") is being quite generally recognized by an ever increasing number of housewives. To increase this patronage the present day baker must adopt modern methods of production, in addition to using the most wholesome ingredients.

The up-to-date baker is learning that the electrically heated bake oven is the logical means of producing bread, cakes and pastry of uniformly high quality. "Desire to taste," is created by excellence of appearance, and electrically baked products stimulate the appetite to the highest degree. Hygienic baking is assured by the adoption of the electric oven because of its established cleanliness, due to absence of fuel fumes, ashes or debris.

These ovens can be erected in any convenient place because there is no necessity for chimney connection. Due to the use of the thermostat the temperature can be maintained automatically at any desired point, thus preventing overbaking or underbaking. This results in a product which will remain fresh for a longer time because of the greater amount of moisture retained in the bakestuff as a result of the use of electric heat. Some of these ovens have a capacity of 4,000 1-lb. loaves per hour.

For frying doughnuts by electric heat an automatic machine of comparatively small size is now on the market. To obtain doughnuts which are not "heavy" or full of grease the fat must be held steadily at a very definite temperature. Should this temperature vary even a very few degrees the resulting product is of very poor flavor and is practically indigestible. With the automatic electric control a uniformly wholesome product is obtained at all times. One type of electric doughnut machine has a capacity of 40 dozen per hour.

In the roasting of coffee, cocoa-beans and peanuts electric heat has proved entirely successful and adds materially to the value of the product.

This form of heat is also being used largely for roasting of grains and other food products and in curing and roasting so-called "breakast foods" has demonstrated its supremacy. The manufacture of macaroni is greatly facilitated by the use of large electrically heated presses. Electric heat has an unlimited range of application.

Electric bake oven in small restaurant. This oven in the Coffee Club at Santa Rosa is located in the dining room. It does not give out heat into the room. It cooks pastry, bread, meats, etc., to serve 400 people daily at an operating cost of approximately $1 a day. Installation by Mundell Electric Company, Santa Rosa.

Better Merchandising

To Put Electric Toast on Every Table—Co-operate!

Dealers Willing to Work Together Can Handle Successful Co-operative Appliance Campaigns Similar to Power Company Programs

MERCHANDISERS of electrical appliances are fellow-suffers. Whether they like it or not, their problems are essentially the same. And once in a while Bill Smith on this corner gets to thinking it over in the peace of quiet times and decides to let bygones be bygones and see if he and Tom Brown, the other electrical dealer in town, can't speak to each other again.

For, in the long run, Bill Smith perceives, if he hurts Tom Smith's business he is hurting his own business. Willy nilly, they are blood brothers and can meet their common problem much more advantageously if they face it together than if they spend half their time watching what the other chap may be up to.

There are actual cases on record where Tom Brown and Bill Smith, with this new view of the situation, have made a decisive forward march and have proved the old adage that two heads and two pairs of hands are better than one. In a little city on the Pacific Coast not long ago the three electrical dealers in the city decided to get together on a toaster campaign. They pooled their advertising appropriations. They planned a parade through town with a large replica of the toaster that was to be sold on board one of the dealer's trucks and a big poster telling of the forthcoming toaster event. They decided on one make of toaster for the feature special and together bought in sufficient quantity to get a good price.

Considering that it was the first thing of its kind in the city and that they were inexperienced in a campaign of this sort and did not know how to take full advantage of it, the results were very creditable. The worst difficulty came as a result of "cold feet" after the campaign had barely started. The results did not come in fast enough and the campaign dropped just when it should have been pushed with redoubled effort.

It Takes Backbone

Electrical merchandising takes courage and persistence. The special campaign requires even more. It requires fortitude and staying power. The public must be brought first to the buying point. This takes a careful plan and a persistent advertising campaign. The independent dealers who have made campaigns bring business to the stores have done so by seeing them through to the finish. Many times the dealer, looking over the books at the end of a campaign, wonders if it has profited him anything for the effort. The campaign appliance, sold at a close margin, has brought him negligible results, perhaps. Based on the one appliance featured the game hasn't seemed worth the candle.

TOAST!
THIS is Electric Toaster month, and we are making a special effort to let everybody in on the benefits of electric toast.
Once you have eaten toast made on this fine Electric Toaster you will feel that breakfast is never complete without your toast.
Toast can be made right at the table and eaten while still warm and delicious.
Special Prices for March
Each month the electrical dealers in this territory feature some special item. This is your opportunity to get a standard toaster at a distinct saving.
AT YOUR ELECTRIC DEALER'S
or
Southern California
Edison Company
Owned by those it Serves

Advertising run by power company, tying-in with dealers for toaster campaign.

No electric dealer should look upon a campaign as an end in itself. The successful merchant in other lines never contents himself with featuring a special price on one article. He uses the special feature to bring people to his store. Once brought in he demands of his salespeople that they sell to each one as many articles at standard prices as possible.

If it is toasters at $3.95 that are being featured no person who comes to see that advertised article goes away without being shown the standard grade, nationally advertised and list price toasters also carried in stock. Every effort is made to sell these rather than the special. Every customer or prospect is advised to buy a few lamps to keep handy in case of burnouts, or else she is shown a bridge lamp or an electric refrigerator.

In the territory served by one power company conducting co-operative appliance campaigns with local dealers the number of standard grade, nationally advertised and list price appliances sold as against the special featured article, is eight to ten.

Campaign Fundamentals

Successful campaigns in the co-operative merchandising of special appliances have been possible when the following simple rules were rigidly laid down and followed. If they have worked before no doubt they may be made to work again in this year's national toaster campaign, to be held during March and eary April. Try them on your locality.

Get together with the other dealers in your community. There is no reason why, if you have to fight, you cannot fight a common condition rather than be common and fight each other.

Lay out a plan carrying you through the whole campaign, right on past the finish.

Prepare the field by sowing judicious advertising. Get a list of customers from the power company and send them letters about your feature appliance. When the company recovers from the shock if it is wise it will co-operate with you and help you put it on.

Make it spectacular. Put on a parade, a contest, an advertising stunt of some kind to get people talking about and wondering about your campaign. Don't let the excitement die. When you have their curiosity excited hit them with some other advertising feature. Make it different from the first. Before they have time to lose interest either bring them to your stores to get the appliances or bring your store to them through salesmen to sell them the appliance. Before you end your campaign fire a final round of ammunition to let them know that it will all be over in a day or two and the opportunity of the year gone.

Close your campaign with a snap. Bite it off sharply. Take the featured appliance off sale on the dot and return to list prices.

Electrical appliances demand a different type of appeal than would wearing apparel.

Direct-Mail in Electrical Advertising

BY

JEAN BLUM*

Manager Blum's Advertising Agency, San Francisco

BEFORE attempting to go into the subject of the use of direct-mail in electric advertising, let us take a bird's-eye view of the industry, its market, and its advertising.

The Industry

The electrical industry as a whole represents some 6,250 central power stations, about 1,800 manufacturers and jobbers and has approximately 47,000 retail outlets.

The amount of capital invested in this huge industry is estimated at more than $17,000,000,000 and its gross annual turn-over is estimated at about $4,000,000,000.

The principal income of the industry is derived from two sources: the industrial field and the home.

The Market

In the industrial field there are some 535,000 business concerns who use central station current for light and power and more than 2,265,000 stores and lesser business firms using power for lighting and minor electrical appliances.

In the home field, out of a total of 26,219,000 dwellings, it is estimated that 13,253,000 are wired for electricity, or a little more than 50 per cent.

The potential market for additional central station lighting service was estimated in 1925 to cover 4,890,000 homes, of which more than 302,000 are located on the Pacific Coast.

In the electrical appliance field, the following interesting tabulation has been made by Electrical Merchandising, showing number of units now in use in the home.

Electric irons	8,500,000
Vacuum Cleaners	4,300,000
Electric fans	3,800,000
Electric washing machines	3,300,000
Electric toasters	1,300,000
Percolators	600,000
Ironing machines	160,000
Dish washers	100,000

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Another estimate shows that out of every thousand homes wired for electricity, 720 now have electric flatirons, 360 have electric fans, 295 have washing machines, 112 have toasters, and 12 have ironing machines.

Advertising Objectives

As I understand it, electrical advertising aims at certain definite objectives in its respective fields.

In the industrial or business field, electrical advertising must "prove its case" as an economy factor before it can hope to receive favorable consideration. Its aspect must be technical, and its keynote must stress the labor-saving, time-saving, and money element.

As a keen analysis of the possibilities of Direct-Mail in selling electrical merchandise this and the two succeeding articles on the same subject cover the field from all angles, those of the manufacturer, jobber and dealer. The writer is well known as a qualified and experienced authority on this valuable subject.

In the home field, which is the next largest consumer group, electrical advertising has manifold objectives, some of which are not very clearly defined.

The keynote of most electrical advertising to the home that I am familiar with is of an educational nature. Some of it stresses convenience, some, again, points to the time-saving element. As a whole, electrical advertising is performing a remarkable function and accomplishes great things for the industry.

Talking to the industrial business executive requires an intimate understanding of his particular needs and plain business facts, logically presented.

Talking to the Woman

Talking to the woman in the home requires an understanding of her problems, as she sees them. The two are entirely different and apart, and should be so considered.

In my opinion, in order to sell more electrical goods in the average home, it is necessary to go beyond the splendid type of educational advertising which is usually being done.

Here are a few of the objectives I believe electrical advertising should aim at:

1. It should try to overcome prejudice. By that I mean the average woman's fear of danger, costliness of the appliance and the intricacies of handling it.

2. It should try, where possible, to overcome the "mystery" angle. By "mystery" I refer to a lack of taking the reader into confidence as to exactly how the appliance works, why it cannot get out of order easily, and similar information.

3. Electrical advertising for the home should stress, wherever possible, the economy of power consumption and lasting qualities of the featured appliance. Charts on the subject are more easily understood than long drawn out verbiage.

I am bringing out these points because it must be remembered that electrical appliances do not carry the same appeal to a woman as would wearing apparel, or home furnishings. She is not quite as receptive to electrical goods as she might be; therefore, convenience, time-saving, cleanliness, economy, and lasting qualities are essential features.

Stressing one point at a time, and presenting it clearly and in plain language, will accomplish more in electrical advertising than the use of large space and a technical description covering too many angles.

Unlike the industrial field, where facts and figures are necessary, the woman in the home will assimilate less of the facts and more of the information which appeals to her if given to her in small doses.

The Use of Direct-Mail in Electrical Advertising

In discussing with you the subject of the use of direct-mail in electrical advertising it is necessary to give you my definition of "direct-mail" as compared with all other forms of advertising. Here it is:

Every medium of advertising is used for the purpose of telling the public at large about your products or your service. Its function is that of creating favorable acceptance, building good-will and making as many sales as possible.

Direct-mail concerns itself with the more important function of talking to and selling to a given list of potential customers. Its mission is that of turning passive interest created through all forms of advertising into actual sales. It co-ordinates, but does not compete with any other form of advertising.

Advertising or Selling

As an advertising medium direct-mail does not always justify its cost. As a sales medium, direct-mail is the most effective tool in modern business.

> *"As an advertising medium direct-mail does not always justify its cost.*
>
> *As a SALES MEDIUM, direct-mail is the most effective tool in modern business."*

Here are some specific uses of direct-mail in electrical advertising, as they come to my mind:

From the Manufacturer's Side

1. Before launching the advertising campaign, have reprints made of all advertisements and mail copies of these to all dealers and prospective dealers. Take them into your confidence.

2. During the publication period of your advertising campaign, keep your dealers' interest alive by suggestion as to how to "cash in" on the value of the campaign.

3. Every ten days or two weeks after the publication of your advertising, send some sort of letter, card, or message to the retail outlets commenting upon the effect of the campaign, and suggesting means of developing sales for the product.

4. If at all possible prepare a four-page illustrated letter featuring the particular product. Leave the first page blank for imprinting dealer's name. Have a processed letter printed on it telling the consumer that the particular appliance featured is now displayed by the particular dealer whose name appears on the letterhead, and mail these to a selected list of the dealers' customers and prospects.

I could go on for several hours discussing the advantages of dealer sales promotion material by mail, going direct to the ultimate consumer.

(Continued next issue.)

With Longer Days and Shorter Bills Sell Kitchen Lights

How the Coast Counties Gas & Electric Company Sold all its Employees and Then Had Them Earn Back Cost of Own Units by Sales to Neighbors

THE story has become tradition. It almost reads like a fairy tale. "Once upon a time a company decided to sell kitchen lighting units. First it sold all its employees. Then all the employees turned around and sold everyone else. And they all lived happily ever afterwards."

It is a simple formula, but hardly as simple of accomplishment. It is an unusual company which manages to sell all of its employees on the use of even its own most essential services, let alone on kitchen lighting units. In fact it is notorious in many cases that the electrical man, like the bootlegger, seldom uses what he himself sells, and with much less reason.

The Coast Counties Gas & Electric Company, serving the Santa Cruz, Watsonville, Hollister and Gilroy, Calif., communities, in beginning its kitchen lighting campaign last year, first set a quota of 1,000 Miller units equipped with 150-watt lamps which were to be sold to its 13,000 consumers. The commercial department, in planning for the campaign, felt that the regular employees of the company could be the company's best sales force. Regular employees, in the first place, had the company's interest at heart and were known to the community in which they lived as representatives of the company. Their participation in the campaign would be looked upon by the public as a natural thing, whereas if salesmen were to be imported for a short time campaign the public might well regard the activity with less favor.

Believing that
GOOD KITCHEN LIGHTING
Is of great importance, five demonstrations were held this spring attended by 236 people, to show how to keep light on the work and out of the eyes, and to decrease the glare and shadow.
Don't ruin your eyesight by using the wrong lighting system.
The Agricultural Extension Service and Farm Bureau.

Poster used by Coast Counties Company in its campaign, showing university endorsement of better home lighting.

But if employees of the company were to sell kitchen lighting units it would only be logical to expect them to know their value from personal experience. It would be embarrassing for both employee and company to have the prospective customer for a kitchen unit ask the employee if he used one himself and have him reply truthfully in the negative. Kitchen lighting units could not be right for the consumer if they were not right for employees of the company. It became imperative, therefore, that employees first know from personal use the value of the units.

The first campaign, therefore, was an internal campaign. In it the commercial department personally interviewed every employee in the company and did not rest satisfied until every employee, except one or two who lived in a hotel, had purchased a kitchen unit for his own use. This campaign was the more difficult of the two, since it required the utmost tact and yet a determination to make the company itself 100 per cent users of the units later to be sold the public.

This arrangement was made between the company and its employees. They were sold the kitchen units at cost. The units sold for $6.50 and $7.50, according to whether equipped with convenience outlet or not. The employee was then told that he could buy the unit in commissions from the sales of units to his neighbors or to customers of the company. If he sold three units he would thereby get his own unit without cost. For every unit sold over the number required to buy his own he would receive $1 commission in cash for the first 50 units and $1.25 per unit thereafter.

The effect was instantaneous. At the end of the fourth day of the campaign the sales amounted to 1,287 units. In Santa Cruz 550 had been sold, in Watsonville 225, in Hollister 238, in Gilroy 244 and in other small localities 30. The majority of these sales were made by the employees at odd tmes and not during regular hours of employment.

Among the most interesting sidelights of the campaign were these: A gas service man in Gilroy sold 80 units.

A gas worker from the gas plant sold 16 on his day off. The electric trouble man in Santa Cruz sold 70. The bill collector in San Cruz sold 60 units. The wives of some of the employees actively solicited and sold kitchen units, going to the office of the company to collect the commissions for these sales themselves.

The foregoing results were accomplished before the advertising could be more than started. When the advertising got under way envelope stuffers, truck streamers, window displays and newspaper spreads followed, assisting in the closing days of the campaign.

A card index system had been worked out to keep track of all consumers so that calls by employees might not be duplicated. In their enthusiasm the employees disregarded these cards and it was found that where one employee had failed to make a sale at a residence another employee coming back the next day or so would be successful. Another interesting feature of the selling was that the highest sales records were made, seemingly, by employees with the least sales experience. This fact was due, it is thought, to their greater persistence and enthusiasm.

Between Sept. 15, the start of the campaign, and Dec. 1, 1925, orders for 2,444 units were taken from the consumers of the company. In addition to this 137 were sold to employees before the campaign started, bringing the total to 2,581. Of this number only 385 or 14.25 per cent were canceled later, making a net for the period of 2,196 units. The sale of kitchen lighting units has continued from that campaign on, and by Dec. 31, 1926, the total units sold, exclusive of employee sales, were 676 plain units, 910 units with levalier switches, and 964 with convenience outlets, a total of 2,650.

One of the most valuable attributes of the campaign was felt by Morris Wales, general agent of the company, to be the lesson in salesmanship, courtesy and the necessity for the cultivation of friendly relationship with the public which was the result of the campaign. In direct charge of the campaign was M. L. Foster, commercial agent, whose persistence and tact were responsible for the successful culmination of the first part of the campaign, that of selling the employees themselves so completely that they became such good salesmen for the company of their own volition.

"We learned many things as a result of this campaign," said Mr. Wales, in commenting upon it. "The campaign also gave us an insight into many of our employees which no less of a test would have provided. It also taught us that if we wish to sell appliances in our territory we must carry on a house-to-house campaign to get the results we think are deserved for the effort expended. We are still selling kitchen lighting units as a result of this first campaign."

Campaign Conducted During Winter Months

AS THE first step in a general campaign to improve home lighting in the homes served by its system, The Washington Water Power Company of Spokane conducted its first special sale of kitchen lighting units during the six weeks from Jan. 19 to Feb. 28. It was felt that the housewife would readily appreciate any improvement in the lighting of her kitchen, and that having been impressed with the possibilities in that respect, she would feel inclined to effect a similar improvement in other rooms. There were two other considerations that had weight in causing this particular time of year to be chosen for such a sale. It is difficult to find any electrical appliance upon which all the permanent salesmen can concentrate their efforts, and furthermore, with lengthening periods of daylight, the use of lighting is decreasing, so that the effect of increased wattage upon lighting bills is not apt to be noticed.

The execution of the campaign was intrusted to R. B. McElroy, assistant sales manager, Spokane, and J. F. Farquhar, general agent for outlying towns. The ten city salesmen were carfully coached upon the possibilities of this sale, and similar steps were taken to insure that the 24 district agents should have all the information required. The Spokane salesmen were furnished with route lists by the collection department who indicated on these lists those customers whose credit was doubtful. The salesmen were impressed with the need of making every moment count, to effect entrance at the kitchen door so as to be able to start demonstrating the sample lamp in the room where it would be used.

An effectively printed broadside was mailed to all residential customers on the system so as to reach them in advance of any calls. In Spokane two illuminated bulletin boards on principal car lines were installed, and during the six weeks campaign 1,200 in. of advertising was run in the local papers.

-:- TEN DAYS FREE TRIAL -:-
Have More Light In the Kitchen the Place Where Correct Illumination Is Really Needed
75c DOWN
And You Can Have a "Daylite Kitchen Unit" Installed
At 75c down we will install in your kitchen the white porcelain enamel "DAYLITE KITCHEN ELECTRIC LIGHT FIXTURE"
A beautiful fixture that will not tarnish or turn yellow.
Price complete with installation and lamp—
$7.50 without combination switch and convenience outlet
$8.50 with combination switch and convenience outlet
Notice the illustration, it shows the combination switch and convenience outlet to which you can attach—all electric appliances, such as iron, percolator or toaster.
Telephone your order—make a personal call or fill in and mail the attached order card.
THE WASHINGTON WATER POWER COMPANY
This is The Handy Combination switch and convenience outlet.
Date 1925
The Washington Water Power Company
You may install on the ceiling outlet of my kitchen for 10 Days Free Trial your new "Daylite Kitchen Light Fixture" complete with lamp.
If I decide to keep the "Daylite Fixture" I agree to pay 75c down and 75c each month with my light bill until it is paid for.
If within 10 days I decide not to keep the "Daylite Fixture" you are to remove it and replace my old fixture without any cost whatever to me.
Name
Address
Date to install
Cross here is you want fixture with convenience outlet and switch at $8.50 complete.
Cross here is you want fixture without convenience outlet and switch at $7.50 complete.

Broadside used by The Washington Water Power Company in its first kitchen lighting unit campaign. Below a group of the salesmen ready to start following up the mailed broadsides.

RESULTS OF THE CAMPAIGN

	Plain	Convenience Outlet	Total
Suburban towns	275	754	1029
Spokane	282	1945	2227
Grand total	557	2699	3256

Wattage installed per unit ..... 115 watts
Wattage removed per unit ..... 57 watts
Wattage increase per unit ..... 58 watts

Percentage of residential customers sold:
Suburban ..... 11 %
Spokane ..... 9 %
System 9.5%

Special data Spokane:
Total No. of calls 14,532
Total No. of trials ..... 2,903 or 20 % of calls
Total No. Net sales ..... 2,227 or 15.3% of calls

What Price Refrigeration?

Analyses of Increases in Kilowatt-hour Consumption and of Servicing Costs on Electric Refrigerators Made by Colorado Company

JUST what is electric refrigeration costing? What is it costing the customer who buys a refrigerator and places it on the lines at his home at the regular domestic lighting rate for energy? Likewise what is it costing the power company or dealer who sells it to service?

As a general rule the experience of power companies and dealers in this respect has been so limited that no truly reliable figures can be obtained from which to strike general averages. Very few companies have merchandised electric refrigeration long enough or intensively enough to be in a position to answer these pertinent questions.

The Public Service Company of Colorado, however, has been an electric refrigeration merchandiser for perhaps a longer time than most other Western utility companies. It was only natural then, to expect this company to be in a position to lead other Western companies in an analysis of the general refrigeration situation.

Some interesting analyses of the electric refrigeration costs in this company were conducted recently at the request of C. A. Semrad, commercial manager of the company. In submitting them Mr. Semrad comments as follows:

"We have collected some statistics concerning the increased average monthly consumption of electricity in homes where refrigerators have been installed. Due to the fact that many of these installations are not a year old, and that in some of the cases a power rate has been utilized, affording us little data, we were able to collect but twenty cases which would give you true statistical information.

"From an analysis of these twenty accounts we found that the average monthly increase for a year after installation over the year previous to installation was 56.7 kw-hr. or 64 per cent. This means, evidently, that the average required consumption per month was 56.7 kw-hr. for all of the three types of machines we handled. One of the three averaged 42.6 kw-hr. increase, another 69.5 kw-hr. increase, while the third averaged 47.3 kw-hr. increase.

"As to the increase of these loads over previous loads, the average domestic increase amounted to 64 per cent after installation. The first machine mentioned caused an average monthly increase of 74 per cent, the second 91.4 per cent and the third 43.6 per cent.

"These figures have all been based on our regular rate for domestic lighting. Recently we have inaugurated a new refrigeration rate which will benefit slightly the users of the larger machines and the heavier consumers in residences. You understand, I presume, that these installations and accompanying statistics are for domestic machines only, and are distinct from commercial installations or apartment houses."

Accompanying these remarks Mr. Semrad submitted the tables and charts printed herewith. The first table (Table 1) gives an itemized analysis of consumption and of the monthly bills for the twenty machines mentioned. This is followed by a summary of averages for each type of machine. Close consideration of these statistics will repay any refrigeration merchandiser.

TABLE 1

Consumption Comparisons

Installation	Av. monthly consump. before installation		Av. monthly consump. after installation		Monthly increase		Per cent Kw-hr.
	Kw-hr.	Cost	Kw-hr.	Cost	Kw-hr.	Dollars	
1	36.8	$2.96	84	$6.71	47.2	$3.75	129
2	107	8.60	181	14.47	74	5.87	69
3	56.6	3.81	113.5	7.83	56.9	4.02	100
4	176.5	14.12	270.5	22.69	94	8.57	53
5	80.4	6.49	170	13.71	89.6	7.22	111
6	136	11.03	215	17.16	79	6.13	58
7	44	3.81	105	7.86	61	4.05	140
8	83	6.60	111	8.55	28	1.95	34
9	50	3.95	106	8.51	56	4.56	112
10	60	4.15	106	8.57	46	4.42	77
11	78	5.64	116	7.24	38	1.60	50
12	216	18.51	371	28.44	155	9.93	71
13	47	3.80	62	4.97	15	1.17	30
14	30	2.79	93	7.45	63	4.66	210
15	166	13.33	186	12.14	20	1.19*	12
16	45	3.76	73	5.86	28	2.10	62
17	51	4.15	103	7.99	52	3.84	100
18	143	10.11	154	12.05	11	1.94	8
19	55	4.02	98	7.83	43	3.81	80
20	114	7.17	191	10.61	77	3.44	68

(*This bill was changed from A rate to B rate.)

Summary

Average monthly kw-hr. consumption for 20 machines before installation	88.7
Average monthly kw-hr. consumption for 20 machines after installation	145.4
Average monthly increase kw-hr consumption after installation	56.7
Average monthly bill before installation	$ 6.94
Average monthly bill after installation	11.03
Average monthly increase of bill	$ 4.09
Per cent of increase of kw-hr. with installation	64%
Per cent of increase of bill over old bill	59%
Machine A.	
Average monthly kw-hr. consumption for 9 machines before installation	76
Average monthly kw-hr. consumption for 9 machines after installation	145.5
Average monthly increase of kw-hr. consumption after installation	69.5
Average monthly bill before installation	$ 6.21
Average monthly bill after installation	11.27
Average monthly increase of bill	5.06
Per cent of increase of kw-hr. with installation	91.4%
Per cent of increase of bill after installation	81.5%
Machine B.	
Average monthly kw-hr. consumption for 9 machines before installation	108.4
Average monthly kw-hr. consumption for 9 machines after installation	155.7
Average monthly increase kw-hr. consumption after installation	47.3
Average monthly bill before installation	$ 8.25
Average monthly bill after installation	11.70
Average monthly increase of bill	3.45
Per cent of increase of kw-hr. with installation	43.6%
Per cent of increase of bill after installation	42 %
Machine C.	
Average monthly kw-hr. consumption for 2 machines before installation	57.4
Average monthly kw-hr. consumption for 2 machines after installation	100
Average monthly increase of kw-hr. consumption after installation	42.6
Average monthly bill before installation	$ 4.30
Average monthly bill after installation	6.97
Average monthly increase of bill	2.67
Per cent of increase of kw-hr. with installation	74%
Per cent of increase of bill after installation	62%

Servicing Analysis Too

What should be of equal interest to many merchandisers is the detailed servicing cost analysis made by the Public Service Company of Colorado for the period between March 1 and Sept. 23, 1926. Seldom is there presented a more complete and searching analysis of servicing than that presented here. Servicing in few cases has been given more than passing attention or been regarded in relation to its sales aspect. That service on refrigerators installed is a matter of considerable import may be seen by the accompanying tables, the first of which, Table 2, makes a comparison of the total number of installations to the total number of service calls. All types and makes of machines handled by that company are recorded in this comparison. There are five makes of machines and the installations and service calls on each as well as their classification as to domestic, commercial or apartment installations, are noted.

The statistics are taken from 332 installations, not all of which were installed for the full period of time men-machines have been installed largely in apartment houses, the D unit in com-

tioned, it is explained. It will be noted also that of the five machines the number of any one make differed greatly from the numbers of other makes so that in calculating percentages this variation in numbers installed should be taken into consideration.

TABLE 2

TOTAL INSTALLATIONS

Make of Machine	A	B	C	D	E
Apartments	1	12	....	1	2
Commercial	48	11	....	1	....
Domestic (on trial)	15	....	1	....	....
Domestic	135	90	15	....	....
	199	113	16	2	2

TOTAL SERVICE CALLS

Make of Machine	A	B	C	D	E
Apartments	9	210	....	....	46
Commercial	369	36	....	1	....
Domestic (on trial)	62	....	1	....	....
Domestic	702	163	35	....	....
	1142	409	36	1	46

Total installations condensed..... 332
Total service calls on above.....1634
Average number calls per installation..... 5

All types of installations were included in the 332 installations. There were 16 apartment houses; 60 were commercial jobs; and 256 were domestic units. Each of the apartment house jobs might involve from 2 to 30 separate coils with one central machine to approximately every 6 coils. However, in these figures, each apartment house installation has been taken as a unit.

It will be noted that for the total of 332 installations a total of 1,634 service calls was rendered, or an average of 5 per installation. The 199 units of the A machine required 1,142 service calls, the 113 of the B machine required 409 calls, the 16 of the C machine required 36 calls, the 2 D machines required but one call, and the 2 E machines required 46 calls. The E and B mercial jobs and the A and C machines in domestic installations.

Key to Servicing Analysis

An explanation of each item in the accompanying servicing analysis, Table 3, has been submitted as an aid to the interpretation of the "troubles" listed. It is as follows:

Machine O.K. item means either a special call or a routine call where the machine was found by the service man to be working in good condition.

Total Hours spent means the hours that the service man charges up against each job in the allocation of his time.

Miscellaneous service calls are those varied troubles which were not consistent enough to be classified.

Adjust tighter and new belt explain themselves.

Checked means that the machines have been looked over by a service man, usually just after installation, and checked for temperature, etc.

Defrosted means that the machine has been shut down and the temperature lowered to normal for repairing or testing.

Fuses means that a new fuse has been placed in the place of one burnt out in the separate "refrigeration fan box."

Gaskets may apply to any of the gaskets needing replacement.

Low charge refers to a lack of methyl or sodium dioxide. This requires an addition of these chemicals as shown under the items for each. **Overcharge** refers to too much of it.

Motor troubles is rather infrequent, and usually when present is with the brushes.

Noisy and **Oil and adjust** explain themselves. It will be noted that the noise complaint is quite rare.

Repair leak is a rather heavy complaint. The leaks causing it usually are found around the float valve. This item may account for low charge and the amount of methyl used.

New seal refers to the seal of the liquid used.

Set switch and Adjusting temp. are practically the same in meaning and the **Set cooler** and **Set warmer** items explain themselves.

TABLE 3

Refrigerator Servicing Analysis

Trouble	Domestic	Apt.	Com.	Total
Machine O.K.	88	6	35	129
Total hours spent	1159	397	699	2255
Misc. serv. calls	139	49	97	285
Adjusting belt	8	5	...	13
Tightening belt	22	6	6	34
New belt	61	32	23	116
Checked	67	5	50	122
Defrosted	35	5	15	55
Fuses	18	1	11	30
Gaskets	2	2	1	5
Low charge	24	...	5	29
Motor	6	...	12	18
Methyl	96	...	30	126
Noisy	6	...	2	8
Over charge	39	1	7	47
Oil and adjust	101	48	20	169
Routine	31	2	11	44
Repair leak	53	37	18	108
New seal	27	...	4	31
Set switch	40	1	6	47
Starting	9	19	3	31
Set warmer	47	8	13	68
Set cooler	28	16	20	64
Adjust temperature	17	15	7	39
Faulty tank	3	...	...	3
Level machine	2	...	...	2
Flush valve	4	...	7	11
Change float	16	12	2	30
Not home	28	1	...	29
Gas bound	20	...	2	22
$S. O_2$	...	4	...	4
Oil	...	1	2	3
Total serv. calls	1037	266	409	1712

Starting refers to defrosted machines or those stopped temporarily for repair.

Flushed valve refers to the needle valve sometimes stopped by some foreign particle, requiring flushing to clean it.

Change float on a Servel machine explains itself.

Gas bound means that air or gas is interfering with the action of the float.

SO_2 is used in three of the machines and methyl in another.

Service men work on special calls almost all of their time but may make routine calls if not occupied with special calls.

A total of 243 lb. of methyl has been used by service men on calls and a total of 11 lb. of sulphur dioxide.

Stuffed Lion Attracts Crowds for Merchandiser

A window display aid has been put to unusual incidental use by the Public Service Company of Colorado.

This is an automaton, a life-size lion, the head and tail of which move. It was supplied the company by a manufacturer of an appliance.

Exhibited in the regular way, a demand quickly was expressed for this lion by Lions Clubs in various cities. It has appeared at various places in Colorado, sponsored by the local Lions Clubs. In each case a simple card giving credit to the Public Service Company of Colorado appears with it.

Washing Machine Campaign Successful.—A washing machine campaign running from Sept. 15 to Oct. 18 in the territory of the British Columbia Electric Railway Company has been considered one of the most successful campaigns this year. Late shipments of washers have caused the extension of the campaign until the end of the month.

Display Arranged by Refrigeration Manufacturer

Window display arranged by manufacturer to be used in connection with its sales program. It was used to good effect in many cities in the Northwest in connection with a display of machines placed on the floor of the dealer's establishment and by outside salesmen in the field.

Display of electric ranges in the entrance way of a dealer in stoves exclusively in San Francisco. Nearly all of these ranges were sold to tenant-owners of a new community apartment house.

Electric Range Sales Pay Exclusive Stove Dealers

Gernhardt & Strohmaier Find Active Field for Electric Cooking and Establish Electric Department with Trained Range Salesman in Charge

WHO but the exclusive stove dealer, who carries nothing but stoves and ranges of all sorts, should be in better position to know whether electric ranges are to become accepted in American household life? Strange as it may seem the old time stove dealer, as a rule, has not even himself accepted the electric range as anything less than a luxury and hence is not in a position to give authentic information. Either he is too conservative to pioneer with electric ranges, preferring to let the central station and the electrical contractor do that, or he does not see any future in them.

The exception which proves the rule, namely Gernhardt & Strohmaier, located at 18th and Mission Streets, San Francisco, and claiming to be the largest exclusve stove dealer on the Pacific Coast, has not only seen the possibilities in electric ranges but has done a good deal of pioneering on its own hook. It is interesting to know, moreover, that this establishment, which has handled wood and coal ranges, gas and oil stoves and heaters, has had an electric range department operating successfully for over two years.

To L. J. Gernhardt, manager of Gernhardt & Strohmaier, should go the honor of being the first man in the stove business to employ an exclusive electric range and heater salesman. Mr. Gernhardt began selling electric ranges about three years ago but found that the ranges did not move fast enough. Experienced in the selling of other ranges of all kinds he realized that it would take a man with special training devoting his entire time to electric range sales to make this branch of his business pay.

But having made a start in the electric range business and being a believer in its future, Mr. Gernhardt induced F. Allenwood, electric range specialist with the Pacific Gas and Electric Company in the Petaluma district, to take charge of the electric range department in his establishment. That his faith in electric range possibilities has been justified has been borne out in the company's experience with electric range sales since Mr. Allenwood assumed charge of this department. The electric range department has paid its way and is growing rapidly.

As exclusive dealers in stoves on a large scale, the Gernhardt & Strohmaier Company handles practically all makes of ranges. However, the Hotpoint, L. & H. and Westinghouse ranges are featured. Range selling is made the personal business of Mr. Allenwood who works in close co-operation with the power companies and electrical dealers. Because the company is known as a well known and established stove company a great many inquiries for electric range sales come into the store also.

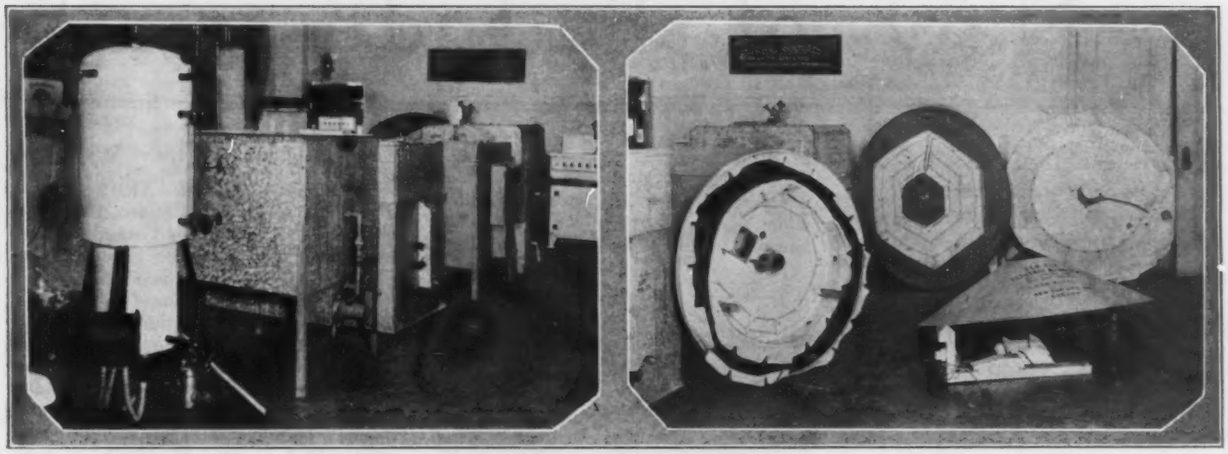
"You would be surprised," says Mr. Allenwood, "at the help given us by customers who have already bought electric ranges and who boost the electric range and give us the names of prospects. We have done everything we can to maintain the friendliest of relations with our customers. They feel that the stove store here is a well established concern and will give them service. I suppose they feel that being stove experts we know the business thoroughly and this helps us, no doubt, to make sales."

Special attention is paid by the electric range department to all new apartments going up in San Francisco and a large number of owners are converted to electric ranges, due to the persistence and salesmanship of the electric range man. The ten full automatic Hotpoint ranges mounted on the cabinet bases shown in the picture at the top of this page have been sold to tenant-owners of the Crown Apartments on Post Street, a community apartment building. Each tenant had to be sold individually the electrical idea. Almost all of the apartments will be equipped with electric ranges.

Nearly all the electrical installation work is handled for the stove company by the Irwin Electric Company of San Francisco. This electrical contractor does the wiring and in turn furnishes leads for range sales to Mr. Allenwood.

Electric ranges are not the only electrical merchandise carried by this establishment. The electric range department also sells and has had installed considerable electric heating.

Farm and Dairy Electrical Equipment Displayed for Meeting



When the Committee on the Relation of Electricity to Agriculture had its meeting in Fresno, The Valley Electrical Supply Company arranged a special exhibit of farm electrical apparatus for the benefit of those attending the meeting. The exhibit included not only electric equipment for the farm home, such as ranges, water heaters, air heaters and electrical appliances, but also displayed electric brooders, dairy sterilizers, pumps and heating elements for space heating uses. The brooder, incubator and dairy sterilizer exhibit was particularly attractively arranged and drew much favorable comment from those visiting it. No attempt was made to sell to the visitors, the exhibit being arranged as an educational feature in conjunction with the C.R.E.A.

Residence Shopping Center Store Proves Successful

What has been described as wonderful success has attended the operation of the new Chilliwack store of the British Columbia Electric Railway Company opened recently in the center of the shopping district known as "Five Corners." Not a little of this success has been attributed to the location of the new store, but the personnel of the new store has also been a factor in the new venture's success. The officers in charge are A. Mansfield and A. J. McWean, the latter of whom was transferred from the Vancouver staff as outside salesman.

Upon the opening day the company gave each light and power customer who attended the opening exercises a 75-watt lamp. Six hundred persons availed themselves of this offer. Over 1,000 people visited the new store.

Although it was felt at first that the new store would detract from the sales of the hardware merchants who had been the sole distributors of electric appliances in that district it has been found that practically all business at the new store has been newly created by it. Sales have increased from less than $100 per month to never less than four figures, according to a statement from officials of the company.

A Correction

An error in computation, due to carrying over totals from one column to the next, caused an error in the totals for electric refrigerators sold during 1926 and in the quota for 1927 as appearing in the Range and Refrigerator Sales and Quotas Chart on page 90 of the February issue of Electrical West. Total refrigerators sold in 1926 should have read 3,185 instead of 30,495, and the quota for 1927 should have totaled 4,316 instead of 34,644.

Electric Shop Makes Record For Year's Sales

A new record for appliance sales for 1926 has been made by the Electric Shop of The Washington Water Power Company, Spokane, Wash., according to a statement made recently by R. P. McElroy, assistant sales manager. A total of 4,551 electric appliances were sold during 1926, an increase of 141 items over business for 1925.

During the month of December all records for the sale of electric percolators were broken, a total of 223 of these appliances being sold within 30 days. This number exceeds the total number of percolators ever sold in the shop during any one year.

Following is a detailed report of the appliance sales for the year: 307 vacuum cleaners, 401 waffle irons, 792 electric irons, 112 curling irons, 352 percolators, 251 toasters, 333 air heaters, 28 grills, 81 hot plates, 42 ironers, 132 washers, 710 ranges, 720 water heaters, 76 heating pads, 71 Electro-Kolds, 143 miscellaneous.

New store of the B.C. Electric Railway Company located at "Five Corners," a residential shopping district.

News of the Industry

Balch Plant Is Dedicated with Appropriate Ceremony

With fitting dedicatory ceremony the Balch plant, the first unit of the San Joaquin Light & Power Corporation's Kings River development project, planned for an ultimate capacity of 495,000 hp., was placed in service Jan. 29.

Luncheon was served at the plant, which is situated on the North Fork of the Kings River 56 miles east of Fresno, Calif., to about 500 guests of the company. Then followed a brief program, with Henry Hawson, vice-president of the Fresno County Chamber of Commerce, acting as master of ceremonies. Ezra W. Decoto, president of the California Railroad Commission, was the speaker of the day. Brief speeches were made by A. C. Balch, former vice-president of the San Joaquin company, after whom the plant was named, and A. G. Wishon, president of the company, who told of pioneering difficulties in locating hydroelectric plants in the rugged Sierra Nevada Mountains. Tribute was paid by A. Emory Wishon, vice-president and general manager of both the San Joaquin company and the Great Western Power Company of California, to Harold K. Fox, construction superintendent, for having completed the plant at a saving of half a million dollars under the estimated cost. The closing of a switch by A. G. Wishon officially placed the plant in operation.

The main features of the Balch plant are an 85-ft. concrete dam at Williams

Balch power house.

crossing, 4 miles above the power house; a 12x12-ft. tunnel driven 19,348 ft. through solid granite; a penstock line 4,482 ft. long, 60 in. in diameter at the tunnel and tapering to 48 in. at a point 290 ft. above the power house where it divides into two 34-in. lines which pass under the river to the power house. The concrete power house

Type of carriage used in handling pipe on the steep inclines traversed by the Balch penstock line.

which because of the precipitous character of the terrain had to be built across the river from the penstock, is equipped with a 33,000-kva., 3-phase, 60-cycle generator driven by two 20,000-hp. impulse-type water wheels operating under a static head of 2,381 ft., the highest head of any plant yet constructed in this country. Power generated at 13.2 kv. is stepped up through three transformers to 135 kv. for transmission. A steel-tower transmission line 39 miles long connects the power house with Sanger substation in the center of the San Joaquin system.

The Balch plant has been planned for the installation of five additional units of the same size as the one just placed in operation. These will be added from time to time as load conditions warrant. The erection of the present plant, which has been completely in charge of H. K. Fox, superintendent of construction, is the San Joaquin company's largest construction undertaking since the Kerckhoff plant was built on the San Joaquin River. About $50,000,000 will be spent in the development of power through the Kings River project, according to present plans.

Full details of the Balch plant appeared in the Journal of Electricity, April 1, 1925, p. 241.

Seattle Plans Further Work on Skagit River Project

The City of Seattle recently filed with the Federal Power Commission an application for a license covering further development on the Skagit River project. The application for a license follows on the heels of the action of the committee in authorizing the preliminary permit covering this project. The application for preliminary permit, however, was filed Nov. 3, 1924. In the interim the city has been conducting its engineering studies. It believes enough data now are available to permit of the consideration of the license.

According to the data submitted with the application, the Ruby dam will form a reservoir of 3,500,000-acre-ft. capacity. The head would be 445 ft. and the primary capacity 83,000 hp. It is planned, however, to install at that dam six 54,000-hp. units. The Diablo dam will back up the river to the Ruby dam. Its reservoir capacity is calculated to be 90,000 acre-ft. The head which would be developed at that point is 320 ft. The primary capacity is estimated at 108,000 hp. Six 47,000-hp. units are to be installed at Diablo dam. The Gorge dam will create a reservoir holding 6,000 acre-ft. This water is to be used in the existing Gorge power plant. The primary capacity there is 150,000 hp. At present 75,000 hp. is installed. The ultimate installation, however, plans to make use of eight 37,500-hp. units.

New Public Utility in Colorado Serves Fifteen Towns

A new public utility company serving fifteen communities in Colorado has been created as a result of the recent transfer of the Arapahoe Electric Light & Power Company of Englewood and Littleton, the Fort Lupton Power & Light Company of Fort Lupton, and the Jefferson County Power & Light Company, Golden, to the Electric Public Service Company of Chicago.

The new company is known as the Colorado Central Power Company. Its officers are: R. A. Pratt, president and treasurer; E. F. Nolting, secretary; E. A. Phinney, vice-president, and R. W. Booze, manager. Mr. Phinney, formerly was president of the Jefferson County Power & Light Company.

The territory covered, which includes 6,000 subscribers, embraces the following communities: Englewood, Fort Logan, Fort Lupton, Golden, Hudson, Indian Hills, Johnstown, Keenesburg, Littleton, Milliken, Morrison, Platteville, Starbuck, Troutdale and Petersburg, Colo.

Moffat Auxiliary Tunnel Was "Holed Through" Feb. 18.

The auxiliary tunnel, or water tunnel as it commonly is called, that parallels the Moffat Tunnel being driven through the Continental Divide in Colorado, 40 miles northwest of Denver, was "holed through" Feb. 18. After the last charge of dynamite had been set off by President Coolidge pressing a golden key and the remaining 8 ft. of rock had been torn away, Gov. W. H. Adams of Colorado and Mayor C. C. Neslen of Salt Lake City climbed over the mass of debris and clasped hands, marking the event that has brought the two states closer together.

Work on the 6-mile Moffat Tunnel, the longest railroad tunnel in the United States, was started in September, 1923. Construction has been carried on simultaneously from both ends, and there now remains about 1,800 ft. to be drilled through before the railroad tunnel will be ready for use. This tunnel is not expected to be completed before next July. The construction of the water tunnel, which runs parallel to the main tunnel at a distance of 75 ft. to the south, has made possible the more expeditious boring of the railroad tunnel, as by cross-cutting from the former to the latter at intervals of approximately 1,500 ft. crews have been enabled to drill in both directions so that several sections of the main tunnel have been under construction at the same time.

Electricity is the motive power being used to drive the Moffat Tunnel, a complete description of which appeared in the Journal of Electricity, Dec. 1, 1925, p. 408.

Court Rules Irrigation District May Use Funds to Lobby

The right of the Imperial Irrigation District to lobby for the passage of the Swing-Johnson Bill has been upheld by the California supreme court. This opinion reverses the decision of Judge Walter Guerin of the superior court rendered at El Centro Dec. 26, 1925, (Journal of Electricity, Jan. 15, 1926, p. 68) that the payment of funds from the treasury of the district to promote passage of the bill was illegal.

The latter decision was handed down in a test case brought by D. R. Crawford, a taxpayer of the district, to restrain B. F. Fly, who had been engaged to go to Washington as the personal representative of the district for the purpose of advocating the passage of the Boulder Canyon project measure, from acting in that capacity. Judge Guerin upheld Mr. Crawford's contentions that the contract with Mr. Fly was against public policy in that it was intended to influence legislation and that the irrigation district was without authority to expend funds for that purpose. The case was appealed.

In rendering its decision Jan. 31 the supreme court drew a distinction between "personal, secret or sinister influence," and "open advocacy of a cause." On the reasoning that the irrigation district body is not wholly a municipal corporation and has been granted unusually broad powers by the state Legislature, Mr. Crawford's second contention was overruled.

It also was cited that the district is entitled to contract with the United States government for the acquisition of water rights and, consequently, is entitled to go through the preliminaries of such acquisition by appearing to show cause.

The ruling is expected to be of great importance to irrigation districts throughout the United States.

Rain and Snowfall Forecast Prosperity in California

After six dry years California is experiencing a wet winter. Rivers are flowing steadily and water in power plant reservoirs is higher than it has been in several years past. There is a heavy fall of snow at the summit of the Sierra Nevada, at Huntington Lake, Lake Spaulding and at the headwaters of the Kings and Kern Rivers, insuring a good spring runoff and abundant water for irrigation and power generation. The water level in the big agricultural valleys is being raised. The heavy rains will produce bumper crops for the farmer, and there will be good pasture for the livestock.

For the first time in seven years the winter season in California has been one of heavy rains, and in an agricultural state, dependent for about half the year upon irrigation, that has an important bearing upon the general prosperity.

The rivers throughout the state are running full, and the water in the reservoirs is at a higher level than it has been for a number of years. Snow at the summit of the Sierra Nevada amounts to about 125 in., and there is a similar heavy fall at Huntington Lake, the Southern California Edison Company's reservoir in the Kings Mountains, at the Pacific Gas and Electric Company's reservoir, Lake Spaulding, and at the headwaters of the Kings and Kern Rivers where the government weather bureaus maintain snow-measuring stations. Though the heavy rains are washing off the top of this snow, causing the rivers to flow more evenly than they have in the past four years, there is a heavy snow pack, insuring a good spring runoff and abundant water for irrigation and power generation.

The water level in the Sacramento and San Joaquin Valleys, those two big agricultural areas of the state, that for years has been getting lower through lack of rainfall and constant pumping for irrigation, resulting in many cases in the curtailment of the use of electrical pumping equipment, is being raised.

The heavy rainfall, coupled with abundant water for irrigation later in the year when the farmer needs it, will produce bumper crops, and for the livestock grower there will be plenty of grass in the pasture lands.

The importance of such a winter best may be understood by reference to conditions in California in 1924 when, following several years of rainfall below normal, there was so little rain that in the southern part of the state power had to be rationed, all kinds of antique and dilapidated steam equipment for the generation of power were pressed into service, and through the system of interconnection power was relayed to southern California, which otherwise would have been in a very serious situation due to lack of electrical energy. In the agricultural areas throughout the state crops failed for lack of water; cattle and sheep were killed to prevent their dying of starvation; and financial and business circles shared in the resultant depression.

The damage that has resulted from the present storms is relatively unimportant. There has been some slight interruption to electrical service, due to poles being blown down by high winds; some small bridges have been washed out; a few highways have been rendered impassable for short periods; train traffic has been delayed. The most serious accident, resulting in the death of eleven and injury to twenty-two, was that caused by a snowslide which destroyed seven of the forty-four buildings in Camp 72 on the Southern California Edison Company's Big Creek project. The camp housed the crews working on the Pitman tunnel, which is to connect Huntington and Shaver Lakes.

Storms bringing deep snow and heavy rainfall have been general throughout the Western states. In southern Oregon landslides incidental to the highest floods in thirty years blockaded the main line of the Southern Pacific Railroad for two days, but no serious storm damage has been reported.

On Feb. 21 the Colorado River flow reached a maximum of 100,000 sec-ft. and the entire river was passing through the unrepaired 1926 break in the levee at Mile 31½. On the afternoon of Feb. 21 the river was falling and the crest of the flood had passed. The break mentioned was not repaired because of its nearness to the end of the levee system.

Looking Up

—Bronstrup in S. F. Chronicle.

Court Gives Chelan Company Right to Condemn Lake Lands

Through a decision recently rendered by the Washington supreme court the Chelan Electric Company, a subsidiary of The Washington Water Power Company, has been given the right to condemn shore lands along Lake Chelan in the Cascade Mountains in connection with the Chelan company's hydroelectric project there.

This decision, unanimous and given by the court sitting en banc, specifically reverses the Chelan County court's action in denying the Chelan Electric Company the right to condemn the land which will be inundated through the raising of the lake. It is, additionally, a decision of considerable moment from a legal standpoint in that the court, aside from reversing the trial court, also upsets a previously controlling ruling made in 1905 and by which similar cases arising in the intervening years largely have been settled.

The 1905 case was that of the City of Tacoma vs. White River Power Company in which the supreme court held that manufacturing and mining are private, and that when electricity is used for such purposes the right of condemnation of property cannot be exercised. The court now takes the position, however, that the manifold uses to which electrical energy is put under the head of manufacturing, including general uses in the home, is sufficient to give it the character and legal right of a public use.

The Lake Chelan plant is to supply the Great Northern Railway with all the power it requires for the electrification of its lines through the Cascades. All but 15 per cent of The Washington Water Power Company's output is used for purposes recognized as public, the remainder being for manufacturing and mining. Frank T. Post of The Washington Water Power Company and Thomas Balmer, general counsel for the Great Northern Railway, contended that, due to "changing conditions of society" and because power from the Chelan plant would be used by the Great Northern Railway, right to condemn overflow land should be granted such a company as a public utility and for the public interest.

The decision will have an important bearing not only on the Chelan development but also upon plans for other important hydroelectric projects in the state.

Utility's Financing Plan Effects Saving in Interest

Interest reductions amounting to about $109,000 a year will be effected by the financing plan of the Los Angeles Gas & Electric Corporation, under which $10,000,000 first and general series bonds due 1961 recently were offered for sale. The proceeds of the issue will be used to redeem all outstanding series "B" 7 per cent and series "C" 7 per cent general and refunding mortgage bonds, aggregating $5,000,000; to retire $1,895,500 series "I" 5½ per cent general and refunding mortgage bonds and to provide extensions to the corporation's system.

The remaining funds will be used in expanding facilities to take care of increasing demands for service.

The bonds are secured by direct first mortgage on real estate holdings in Los Angeles valued at approximately $1,250,000 and by direct mortgages on all properties of the corporation, now owned or hereafter acquired, subject only to prior liens of underlying mortgages.

Pacific Gas and Electric Company Announces 1927 Commercial Department Program

With conservative quotas embracing domestic and commercial lighting, heavy-duty domestic appliances and refrigeration, the Pacific Gas and Electric Company, through R. E. Fisher, vice-president in charge of public relations and sales, and H. M. Crawford, general sales manager, has announced a comprehensive sales program for 1927. The most radical change in the new program is the plan of remunerating salemen, all of whom will be placed on a straight commission basis.

The program is divided into three parts, covering load-building activities in the fields of lighting, heavy-duty domestic equipment and refrigeration. System quotas for lighting include 5,000 portable indirect floor and table lamps, 5,000 kichen lighting units, 3,300 "Duplexalites," 5,000 porch lights with an illuminated street number, 3,300 household lamp kits, 3,840 commercial luminaires and 162,000 Mazda lamps for over-the-counter sales. Quotas for heavy-duty equipment include 3,000 electric ranges representing a connected load of 21,600 kw., 1,400 water heaters wtih a connected load of 6,580 kw., and 3,500 heavy-duty air heaters with a connected load of 11,200 kw., or a total connected load of 39,380 kw. in this field. No definite quota on refrigerators has been set.

The lighting sales program has been designed primarily to increase lighting consumption in the home. The portable indirect floor and table lamps have a capacity of 200 watts and are to be sold on terms of ten months with a 10-per-cent discount for cash. A 3-day trial period is another feature of this campaign. As more than 10 per cent of the residential consumers already have been sold kitchen lighting units, the quota for this activity has been set extremely low. A determined effort is to be made to introduce the "Duplexalite" luminaires with its 200-watt lamp into the dining and living rooms of residential consumers. These fixtures are also to be sold on terms. Two types of household lamp kits are to be offered, each containing lamps of a higher wattage than ordinarily purchased by the consumer. Consumers who have been sold kitchen lighting units will be canvassed for the sale of a kit containing a 150-watt lamp along with several lamps of other wattages. An additional kit containing a 200-watt lamp will be sold to purchasers of portable lamps and "Duplexalites." To encourage further use of light the company will offer a simple and inexpensive porch lantern that includes the house number of the consumer.

All installation work entailed in the sale of this lighting equipment will be turned over to contractor-dealers in the territory.

Salesmen engaged in lighting activity will be paid straight commissions ranging from 18 to 25 per cent of the cash price of the equipment sold. Where automobiles are furnished by the company a charge of 7 cents per mile will be made against the commissions. All salesmen are to be bonded. A system of prizes and bonuses also has been worked out.

Heavy-Duty Domestic Appliances

Heavy-duty domestic appliances will be confined to two makes of electric ranges, two makes of water heaters and three makes of air heaters. All sales will be made direct by company salesmen at list prices and on terms that will permit dealers to compete. Salesmen will be paid a straight commission of 20 per cent where they furnish their own transportation. A 10-per-cent maximum allowance on the cash price will be made for old stoves turned in by the consumer but this amount will be deducted from a salesman's commission where this practice is followed. Where ranges or water heaters are sold to a consumer by a dealer, the salesmen will be paid $5 with a similar payment of $1 for heavy-duty air heaters sold through the same channel.

No provision is made in the program for a flat price for wiring-in ranges and water heaters, but it is recommended that each division work out a schedule of prices with the contractor-dealer in its territory.

The company plans to sell direct the General Electric line of refrigerators. These are to be handled largely by the range and water-heater salesmen. However, the plan of co-operating with other refrigerator dealers through the submission to them of prospects turned in by employees will be continued as it has proved highly successful during the past year. A more elaborate prospect card has been worked out and when a prospect turned in by an employee purchases a refrigerator from a dealer the employee will receive $10. Salesmen are to be paid a straight commission of 10 per cent on refrigerators sold by them.

The sales program contemplates an extensive use of direct-by-mail advertising material as well as newspaper space.

El Paso Electric Company Erects New Service Building

New Service Building of the El Paso Electric Company.

Meter test room in the service building.

A new building recently has been erected by the El Paso Electric Company, El Paso, Texas, to house its distribution department, engineering department-test section, and storeroom.

This building, known as the Service Building, is 130 ft. long by 115 ft. wide and consists of two stories and basement. The main floor accommodates the distribution department office; engineering department-test section; dispatchers' office, installation crews and the auto storage and repair shop. The clubroom is on the second floor, as also the line and underground departments, range and Kelvinator service room, motor repair and radio departments.

The store room occupies two-thirds of the basement, the remainder being used as a storage space for salvaged material.

The meter test room, in which meter tests, relay tests, and load and voltage checks are made, is an important section of the new building. Judging from past indications, the men in charge will be kept busy, for during the last twelve months 9,633 tests were made by the test department. These include meter tests on customers' premises, load and voltage checks on lines and customers' premises, special instrument tests in shop, and relay tests in power plant and substations.

In carrying out its extension program for 1927 the El Paso Electric Company plans to spend more than $1,000,000. Of this the largest item is $540,000, the estimated cost of two new high-pressure boilers, each with a capacity of 1,500 hp., to be installed at the company's power plant. A new coal handling unit and additional wing will be added to the plant to accommodate the boilers, which will probably increase the cost of these improvements. These new boilers will have ample capacity to operate the new generator, leaving the present boiler equipment in reserve. Other items include improvements in the underground system, substations and general office equipment; additional transformer equipment at the power plant; and completion of the change-over from 2-phase to 3-phase operation to provide for more efficient distribution and utilization of electric current.

Bill to Repeal Water Power Act Introduced into Congress

Washington Correspondence.

Significance is attached to the bill introduced by Senator Copeland of New York, proposing the repeal of the Federal Water Power Act. While there is no chance for this bill to receive consideration at this session of Congress, it is regarded as an important development in that it reveals a part of the strategy of Governor Smith of New York in his water-power campaign.

The bill in its entirety reads as follows:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That an act to create a Federal Power Commission, to provide for the improvement of navigation, the development of water power, the use of the public lands in relation thereto, and to repeal Section 18 of the River and Harbor Appropriation Act, approved August 8, 1917, and for other purposes, known as the Federal Water Power Act, approved June 10, 1920, be, and the same s hereby repealed.

"The executive secretary of the Federal Water Power Commission created by the act will file with the Secretary of War all the papers and records in the office of the Commission relating to navigation and construction of dams on navigable streams now in the custody of the commission, all the papers and records relating to the public lands of the United States and the construction of dams in the streams upon the public lands which are under the jurisdiction of the Secretary of the Interior to that department, and all those relating to public lands and streams thereon within the jurisdiction of the Secretary of Agriculture to that department."

An amendment to the Water Power Act which would permit the commission to hire personnel of its own, in addition to those borrowed from the War, Interior and Agricultural Departments, has been proposed by Senator Jones of Washington, the chairman of the Commerce Committee of the Senate, and Representative Parker of New York, the chairman of the Interstate and Foreign Commerce Committee of the House.

Authorship of Meter-Reader Article Announced

So many favorable comments upon the article, "Dogs Prefer Meter Readers," have come in since its publication and so many inquiries have been made as to whether the article actually was written by a meter reader that Electrical West takes pleasure in announcing its authorship.

The article, published anonymously in the January number, was written by Henry Karl Nelson, chief collector of the Montebello district, Southern California Edison Company, a meter reader for a number of years with that company. He is in excellent position, therefore, to give authoritative information as to the behavior of dogs.

Merchandising Meetings to Be Held by Officials on Tour

Officials of the General Electric Company, Edison Lamp Works and the Pacific States Electric Company will make a tour of principal Pacific Coast cities during March for the purpose of holding merchandise meetings and educating electrical contractors and retailers in still more efficient use of electrical wiring, equipment and appliances and in advertising and merchandising methods.

The first meeting with contractors and retailers will be held in Spokane on March 1; the second is scheduled for Seattle March 4, and the third in Portland March 9. The party is expected to arrive March 18 in San Francisco where meetings will be held in the Pacific Gas and Electric Company's auditorium. Los Angeles meetings are scheduled for March 25.

Members of the eastern party are G. C. Osborn, general sales manager of the Edison Lamp Works; H. F. Barnes, of the publicity department, and A. L. Powell, manager of the engineering department. The representative of the General Electric Company is A. L. Atkinson, publicity manager. D. E. Harris, president, and Fred W. Rea, advertising manager, respectively, of the Pacific States Electric Company, together with George W. West, Pacific Coast manager of the merchandise department of the General Electric Company, met the Eastern party in Spokane and will accompany it on the tour.

Personally Conducted Tour

—Photograph courtesy Fumes and Flashes.

J. F. Pollard, vice-president and general manager, Coast Valleys Gas & Electric Company, Salinas, Calif., accompanied by Mrs. Pollard, recently acted as guide to a party of eight of the feminine members of that organization that made a trip to Lake Tahoe and to the Western States Gas & Electric Company's El Dorado power plant on the South Fork of the American River. In the photograph, which was taken in Stockton, are Marie Lamb, Katherine Kalar, Sophie Underwood, Olive Smith, Mildred Hinrichs, Evelyn Wythe, Annie Andersen, Dorothy Donahue, and Mr. and Mrs. Pollard.

Schedule of Rates for Combination of Service Filed by Utah Utility

The Utah Power & Light Company has filed with the Public Utilities Commission of Utah, effective Feb. 14, 1927, a new optional schedule of rates for domestic electric service. The new rates pertain to combinations of service only, such as lighting and cooking; lighting, refrigeration and cooking; lighting, refrigeration, cooking and water heating.

The new rate schedules are as follows:

Net Charges—Effective in Salt Lake City and Ogden

Residential Lighting and Cooking.

$2 per month for four rooms or less, including 34 kw-hr.
35c per month for each additional room, including 6 kw-hr. per room.
2¾c per kw-hr. for all excess.

Residential Lighting and Refrigeration

$2 per month for four rooms or less, including 34 kw-hr.
35c per month for each additional room, including 6 kw-hr.
4.5c per kw-hr. for all excess.

Residential Lighting, Refrigeration and Cooking.

$3 per month for four rooms or less, including 51 kw-hr.
35c per month for each additional room, including 6 kw-hr. per room.
2¾c per kw-hr. for all excess.

Residential Lighting, Cooking and Water Heating.

$3.50 per month for four rooms or less, including 60 kw-hr.
35c per month for each additional room, including 6 kw-hr. per room.
2¾c for the next 150 kw-hr. per month.
2¼c per kw-hr. for all excess.

Residential Lighting, Cooking Refrigeration and Water Heating.

$4 per month for four rooms or less, including 68 kw-hr.
35c per month for each additional room, including 6 kw-hr. per room.
2¾c for the next 150 kw-hr. per month.
2¼c per kw-hr. for all excess.

Net Charges—Effective in all territory served by the company's inter-connected system (in Utah) except in those cities where the company's franchise expires before Jan. 1, 1930.

Residential Lighting and Cooking.

$2 per month for four rooms or less, including 28 kw-hr.
35c per month for each additional room, including 5 kw-hr. per room.
2¾c per kw-hr. for all excess.

Residential Lighting and Refrigeration.

$2 per month for four rooms or less, including 28 kw-hr.
35c per month for each additional room, including 5 kw-hr. per room.
4.5c per kw-hr. for all excess.

Residential Lighting, Refrigeration and Cooking.

$3 per month for four rooms or less, including 42 kw-hr.
35c per month for each additional room, including 5 kw-hr. per room.
2¾c per kw-hr. for all excess.

Residential Lighting, Cooking and Water Heating.

$3.50 per month for four rooms or less, including 49 kw-hr.
35c per month for each additional room, including 5 kw-hr. per room.
2¾c for the next 150 kw-hr. per month.
2¼c per kw-hr. for all excess.

Residential Lighting, Cooking, Refrigeration and Water Heating.

$4 per month for four rooms or less, including 56 kw-hr.
35c per month for each additional room, including 5 kw-hr. per room.
2¾c for the next 150 kw-hr. per month.
2¼c per kw-hr. for all excess.

The schedules apply to alternating current service supplied at 110, 220 or 440 volts for lighting, domestic appliances and for the particular classes of service specified in each schedule, and measured by a single meter, and are offered only to consumers who have such combinations of service.

It is specified also that the connected load of water heaters shall not exceed 3 kw. and they shall be so connected through a double-throw switch with the range that only one of these appliances may be operated at one time. Any motor used under these schedules shall be single phase and not exceed 1 hp. in rating.

The net bill as calculated under these schedules, increased by 10 per cent, will constitute the gross bill. The net bill applies only when bill is paid within the discount period. When not so paid the gross bill will apply.

The minimum monthly charge is dependent upon the number of rooms. In determining the number of rooms and the minimum monthly charge, the schedules provide that all rooms shall be counted except attics, unheated sleeping porches or other porches, unfinished basement, bathrooms, closets, laundries, pantries, vestibules, hallways not used as living or reception rooms, garages or barns without living quarters. Combination living rooms and reception halls, living rooms and dining rooms, or other rooms, of such size as to require lighting fixtures equivalent to those required by two ordinary rooms, shall be counted as equivalent to two rooms. The contract period is specified as one year, renewable.

Two New Power Companies Incorporated in Japan

Two new power companies recently have been incorporated in Japan, according to Denkinotomo. The Sukawa Electric Power Company, incorporated at Tokyo with a capital stock of ten million yen, proposes to appropriate water from the Azumagawa and Odagawa Rivers for the development of 62,000 kw. The entire output is to be sold to the Tokyo Electric Power Company. The Showa Electric Power Company, a joint project of the Daido and Kuhara interests, was incorporated at Tokyo with a capital stock of 45,000,000 yen.

Another company recently incorporated at Niigata Prefecture is the Nippon Electric Industry Company, with a capital stock of 7,000,000 yen. The company will engage in the construction of power houses, transmission and distribution lines for power companies.

Permit Asked for Power Project Near Humptulips, Wash.

William H. Hopkinson of Aberdeen, Wash., has made preliminary filing for a $200,000 hydroelectric power plant to be located at a point near the Grays Harbor cities of Aberdeen or Hoquiam.

The filing, as placed at the office of R. K. Tiffany, state hydraulics supervisor, Olympia, asks an appropriation of 50 sec.-ft. from the flow of the West Fork of the Humptulips River, flowing out of the lower Olympic Range. An undescribed diversion dam situated six miles northeast of the town of Humptulips would route the water through 25 miles of pipeline to the power house, which would have an estimated output of 2,000 hp.

Mr. Hopkinson recently filed for smaller rights on the East Fork of the same river.

Hetch Hetchy Project to Need More Funds Next Year

The $10,000,000 bond issue voted in 1925 to provide funds for San Francisco's Hetch Hetchy project will have been expended by the end of the present year and another bond issue or issues to the amount of $24,000,000 will be necessary to complete the project, according to a report made by the city engineering department to the public utility committee of the board of supervisors. Of that amount $16,000,000 will be used for tunnels and $8,000,000 for pipe lines.

The report pointed out that the Hetch Hetchy project does not include a distribution system and the purchase of the Spring Valley Water Company properties, on which the city has an option of $37,000,000, is contemplated as a necessary adjunct to a complete water system.

Denver Company Women Form First-Aid Team

A first-aid team of ten girls employed by the Public Service Company of Colorado, Denver, is to be a nucleus through which all women members of the Henry L. Doherty Company in the state will be taught rudimentary first aid.

The team organized six months ago by Miss Inez Thompson, is under the direction of F. A. Tewksbury, the company's superintendent of safety. For fifteen years Mr. Tewksbury has preached the value of having every employee familiar with first-aid work. His men's teams have given demonstrations in saving lives in practically every city in the state, and to date the saving of three lives can be traced to the fact that workers were able to revive patients, overcome by gas and electric shock, through the Schaefer prone pressure method of resuscitation.

Miss Helen West, one of the team, recently was credited with having saved the life of a motorist whose wrist had been severely lacerated in an accident.

News Briefs

Index to Journal of Electricity Ready.—An index to Volume 57 of the Journal of Electricity covering issues from July 1 to and inclusive of Dec. 31, 1926, has been prepared and copies may be obtained upon application to the office of Electrical West, formerly the Journal of Electricity, 883 Mission Street, San Francisco.

Hurley Prize Awards Jury Announced.—The Hurley prize awards jury has been announced by J. E. Davidson, chairman, Commercial National Section, as consisting of C. E. Greenwood, The Edison Electric Illuminating Company, Boston, chairman; G. E. Miller, Cleveland Electric Illuminating Company, Cleveland; S. D. Heed, Electric Household Utilities Corporation, Chicago; Earl Whitehorne, commercial editor, Electrical World; Ell C. Bennett, editor, Electric Light and Power.

California Leads in Transmission Line Mileage.—The number of miles of electric transmission lines in California is 32,863, according to the last federal census of central stations, giving that state the lead over the other states in the Union. New York follows with 17,567 miles; Pennsylvania next with 9,101 miles; and Illinois fourth with 7,975 miles.

Whatcom County, Wash., Grants 50-year Franchise Over Unserviced Roads.—The Puget Sound Power & Light Company, Bellingham, Wash., has been granted a 50-year franchise by the Board of Whatcom County Commissioners to extend power lines over numerous unserviced roads in widely scattered areas throughout the county.

Company to Spent $4,000,000 in Electrification of Steel Plant.—In an address before the Pueblo Real Estate Exchange, H. B. Carpenter, general superintendent of the Colorado Fuel & Iron Company, Pueblo, stated that approximately $4,000,000 will be spent by the company during 1927 in further improving the company's steel plant which has been undergoing electrification. For the fifth time since the rail mill of the Minnequa plant was electrified, it has broken previous production records. A recent night shift rolled 878 tons of finished rails.

Tacoma Applies for Rights for Water Resources Development.—The City of Tacoma has applied to the state supervisor of hydraulics for permission to appropriate 625 sec.-ft. from the Puyallup River, 100 sec.-ft. from Voight Creek and 80 sec.-ft. from Kapowsin Creek. The water would be used in connection with furnishing water for commercial water-power plants, canneries, coal mines and various other manufacturing uses. The project, estimated to cost $2,000,000, would be known as the Kapowsin Lake Diversion System. Kapowsin Lake, about 35 miles southeast of Tacoma, is to be headed by a concrete dam 50 ft. high and raised to store 50,000 acre-ft. of water.

Oroville, Calif., Plans to Acquire Electric Distribution System.—The city of Oroville, Calif., is planning to hold a special election to vote on a proposed bond issue of $150,000 to acquire the electric light and power distribution system of the Pacific Gas and Electric Company within its municipal limits, the power to be supplied by that company. The cost of the system is estimated at $125,000 and severance charges at $25,000. At the first reading of the ordinance giving notice of the special election the date of the election was set as March 14.

Women's first-aid team of the Public Service Company of Colorado, Denver. Back row, left to right—F. A. Tewksbury, superintendent of safety and director of the team; Deva Baldwin, Lucia Andrews, Mary Miller, Emma Marshall, Violet Giddings and Field Brown, assistant director. Front row, left to right—Helen West, Dorothy Hutton, Evelyn Dane, captain; Katherine Keck and Stella Marple.

Denver by Vote of Two and a Half to One Renews Power Company Franchise

By a majority of two and a half to one, voters of Denver on Feb. 8 registered their approval of the twenty-year franchise submitted by the Public Service Company of Colorado, the Cities Service (Doherty) subsidiary operating the gas and electric utilities in that city.

While the total vote cast was comparatively light, the franchise received substantial majorities in all but two of the 293 voting precincts, these majorities in some precincts running as high as ten and twelve to one. Of a total of 23,317 votes cast, the franchise proposal received 19,354 favorable ballots, with 7,963 against it. One precinct returned a majority of 13 votes against the franchise, while in another the vote was a tie.

The election marked the successful culmination of the company's efforts to renew its Denver franchise. In May, 1925, one year prior to the expiration of the then existing contract with the city, the voters rejected the utility's franchise proposal by approximately the same majority as was recorded in favor of the latest agreement.

The campaign in support of the new franchise, which becomes effective immediately, was characterized by the endorsement of city officials, including the mayor, the city attorney and the Denver council, of civic leaders and numerous organizations, and favorable news and editorial comment in the Denver press. Daily newspapers of Denver without exception, urged the approval of the franchise, and the weekly press, with a single exception, favored the proposal.

Chief among the provisions of the new franchise is an electric rate revision which will benefit customers by approximately $675,000 annually. The company also agrees to provide natural gas at such time as an adequate supply is found near Denver, or to construct a pipe line from more distant fields when a feasible plan can be found. Other provisions include the payment of an annual franchise tax to the city of $60,000 a year, a reduction in the gas rate, agreement to purchase hydro-electric power from the city at a rate to be determined by a board of competent engineers, should the municipality ever develop a plant in connection with its water-supply source, purchase by the company of an underground wiring system owned by the city, an acceptance of a specified daily average heating value of manufactured gas.

Immediately after the outcome of the election became known, Clare N. Stannard, vice-president and general manager, confirmed a previous announcement that the Public Service Company contemplated an expansion program involving the expenditure of $40,000,000 during the next few years.

Addition of a third generating unit and more boiler equipment is planned for the Valmont power plant, north of Denver, at an estimated cost of $700,000. Construction of a new warehouse and service building in Denver, costing $500,000, will be started at once. About $450,000 will be spent on the extension of gas mains and electric distributing systems. The company also will spend $800,000 for the improvement and enlargement of the present gas-manufacturing plant, should it be found impracticable to invest from $8,000,000 to $12,000,000 in natural gas pipe-line construction. In addition, a general program of construction and maintenance that has been delayed by the franchise negotiations will be undertaken immediately, and will involve several hundred thousand dollars in expenditures.

Distinguished Service Medal for Power Company Employees

As a means of recognizing acts or services of its employees that "cannot be measured in terms of dollars and cents" the Pacific Gas and Electric

Company has adopted an emblematic award to be known as "The John A. Britton Medal for Distinguished Service," according to announcement of Frank A. Leach, Jr., first vice-president and general manager.

The order of distinction will be divided into two classes, the first degree of distinguished service to be recognized by the award of a gold medal, the second degree by a silver medal. The announcement continues:

> The gold medal may be awarded in recognition of any act in which an employee attempts to save human life, to prevent injury or to prevent damage to company property, at the risk of his own personal safety. It may be awarded in recognition of any unusual display of courage and judgment in averting a catastrophe or in handling a serious emergency. It may also be awarded in recognition of any exceptionally noteworthy and valuable contribution to the development of the business of the company.
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> The silver medal may be awarded in recognition of any action to save human life or to prevent injury where the element of personal danger is not present. It may be awarded for some outstanding act of lesser significance than that of the gold medal award, but nevertheless important and valuable, calling for recognition. It may also be awarded to those whose acts or services have contributed to an act or service forming the basis of a gold medal award.
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> A certificate will be presented with each medal which will carry a citation of the service for which the award is made. Every employee of the Pacific Gas and Electric Company will be eligible for consideration for either one of the awards.

A facsimile of the design for the medal is shown in the accompanying illustration.

Arizona Utility's Articles of Incorporation Amended

The Central Arizona Light & Power Company, operating the light, power and gas utilities in Phoenix, Ariz., has been rechartered by the Arizona Corporation Commission. Assent has been given to amendments to the articles of incorporation, increasing the capital stock to 350,000 non-par-value shares, 50,000 to be preferred, with annual return per share of either $7 or $6 as the directors may decide.

The commission has been asked to ratify the sale of 7,500 shares of $7 preferred stock at not less than 96, and the exchange of 200,000 shares of the new common stock for 40,000 shares of the old. Nearly $2,000,000 has been spent by the company for improvements made within the past five years, with an improvement budget of $400,000 for 1927.

The corporation has an auxiliary steam plant in the city of Phoenix, but secures most of its current from the Salt River Valley Water Users' Association and the Arizona Power Company.

Longview Public Service Co. Sells its Holdings

The Longview Public Service Company, Longview, Wash., has sold its electric light, power and water holdings to the Washington Gas & Electric Company of New York. The latter firm owns and operates gas and power plants in 400 cities and 12 states, and operates four plants in Washington at Aberdeen, Hoquiam, Chehalis and Centralia. The Longview holdings will be in charge of C. Y. Bowers.

The company will buy all its power from the Long-Bell Lumber Company, whose power plant will be enlarged from 18,000 to 24,000-hp. capacity, with the addition of a 6,000-kw. generator and two boilers. The Long Bell Company furnishes electricity for Longview, Ryderwood and several other towns in the vicinity.

Two Power Plants Planned for American River Forks

Application has been filed by W. J. Prewett, Auburn, Calif., with the California division of water rights for permit to divert water from both the North and South Forks of the American River for the generation of electrical energy by two plants, whose combined capacity is given as 129,000 theoretical horsepower.

For the plant on the South Fork permission is sought to divert 1,000 sec.-ft. and to store 430,000 acre-ft. of water. The erection of a 275-ft. dam is proposed. For the plant on the North Fork, which will be the larger of the two, 1,250 sec.-ft. and 550,000 acre-ft. are asked. The dam is to be 350 ft. high. The application states that it is proposed to sell the power developed to existing power companies.

Women Offered Short Course in Electrical Equipment

A short course in electrical equipment will be given by the Home Economics Department of Iowa State College, Ames, March 14-19. This course, which is the first of its kind, and one which fills a long-felt need, will be open to women interested in the electrical industry. The Women's Committee, Public Relations National Section, National Electric Light Association, is co-operating with the college in offering this electrical housekeeping school.

The purpose of the course is to give technical and non-technical information on the application of electricity to the processes of housekeeping that will be useful to women in their public relations work, publicity and advertising activities and in their presentation of household equipment for home use.

Instruction will be in charge of Eloise Davison, associate professor of home economics, Frank D. Paine, professor of electrical engineering, and other Ames instructors. Assistance will be given by representatives from the public utility industry. Lectures, demonstrations and laboratory methods will be used in the instruction.

No fee will be charged for the course. The cost to the student will consist only of traveling expenses to and from Ames, board and room. Further information desired regarding the course can be secured from Miss Eloise Davison, associate professor of home economics, Iowa State College, Ames, Iowa.

Pacific Coast Electrical Association

Commercial Section Conclave Set for March 9-10

With a program featuring G. B. Buck, manager, electric sales department, Public Service Company of Colorado, and chairman of the Commercial Section of the Rocky Mountain Division of the N.E.L.A., W. L. Frost, general commercial manager, Southern California Edison Company, and one speaker yet to be announced, plans have been perfected for the spring conclave of the Commercial Section of the Pacific Coast Electrical Association at Los Angeles, March 9-10, 1927. All meetings will be held in the Los Angeles Chamber of Commerce Building.

G. B. BUCK

Wednesday, March 9, will be given over to meetings of the various committees of the section at which time reports to be submitted at the June convention will be discussed. There also will be a meeting of the executive committee on that day. Thursday morning also will be given over to committee meetings. The feature of the conclave will be a general session Thursday afternoon at which Mr. Frost, Mr. Buck and a third speaker will discuss phases of central-station commercial development. It is planned to invite all electrical contractor-dealers and jobbers in the vicinity of Los Angeles to attend this meeting.

H. K. Griffin, chairman of the Commercial Section, in a statement regarding the importance of the coming conclave urges the attendance of as many commercial men as possible.

Convention Committee Chairmen Are Appointed

Committee chairmen appointed by S. Waldo Coleman, president, Pacific Coast Electrical Association, to handle arrangements for the annual convention to be held June 14-17, have been announced. R. L. Cardiff, Coast Counties Gas & Electric Company, Santa Cruz, is general convention chairman. The other chairmen and the committees they head are as follows:

Banquet—M. F. Wales, Coast Counties Gas & Electric Company, San Francisco; entertainment—Clark Baker, Sr., National Lamp Works, Oakland; (Mr. Baker is general chairman and will select sub-chairmen); finance—H. W. Johnson, Coast Counties Gas & Electric Company, San Francisco; hotel—M. L. Foster, Coast Counties Gas & Electric Company, Santa Cruz; local transportation—A. E. Strong, Coast Counties Gas & Electric Company, Santa Cruz; program—R. R. Cowles, Pacific Gas and Electric Company, San Francisco; publicity—W. A. Cyr, McGraw-Hill Company of California, San Francisco; reception—P. M. Downing, Pacific Gas and Electric Company, San Francisco; registration and attendance—F. E. Boyd, General Electric Company, San Francisco; Tuesday luncheon—R. E. Smith, Southern California Edison Company, Los Angeles.

Plans for Water Heating Survey Made at Committee Meet

Plans for the immediate undertaking of the survey of metered water heating in California were perfected at a meeting of the water heating committee of the N.E.L.A. held in San Francisco Feb. 3-4, 1927. An outline of the information desired by the committee and the appointment of an engineering subcommittee actively to supervise the tests were the important features of the meeting.

Discussion by the members of the committee present indicated that the need for definite information on the characteristics of the water-heating load is fully as important as the need for electric-range information prior to the undertaking of the electric-range survey. At the present time there is little or nothing known on the diversity or average demand of groups of large-capacity heaters.

It is the plan of the committee at the present time to undertake a preliminary test of a group of water heaters in the San Joaquin Valley for the purpose of determining the method to be pursued in performing the tests and for making an estimate of the total appropriation that will be required from the N.E.L.A. It is hoped that a serial report will be ready for presentation at the June convention of the N.E.L.A.

A preliminary outline of the information the committee anticipates securing follows:

1. The average monthly kw-hr. consumption per water heater.
2. Diversity of water-heating load.
   a. Charts giving load characteristics of a group of water heaters segregated as to type of installation and size of heater.
   b. Answers to a questionnaire as to living conditions of the family occupying each home under test.
3. Relation of average water-heater peak to system peak.
4. Charts giving load characteristics segregated as listed below on the same installations for each of three types of heaters and the average of ten installations:
   a. Water-heater load.
   b. Range load.
   c. Total load of home under test.
5. Rates for each installation tested.

It is expected also that a test will be made on a group of apartment-house water heaters to obtain a study of average hot-water consumption in a home.

Transportation Section to Hold Conference.—Under the chairmanship of S. B. Shaw, Pacific Gas and Electric Company, San Francisco, a two-day conference will be held by the Transportation Section, P.C.E.A., in Fresno, Calif., March 10-11, in the San Joaquin Light & Power Corporation Building. A full attendance is urged by Mr. Shaw as many matters of vital importance are scheduled for attention.

Northwest Electric Light & Power Association

Discussion at Commercial Section Meeting Brings Out Valuable Information

Water heating, merchandising appliances, commercial cooking, competitive power and street lighting were the topics of most outstanding importance discussed at the midwinter meeting of the Commercial Section of the Northwest Electric Light and Power Association at the Multnomah Hotel, Portland, Feb. 7-8, 1927. All committees of the section but one were heard, and in the subsequent free and open discussion many points instructive to commercial departments were brought out. Registration at the meeting numbered about fifty.

The first session was opened by the section chairman, George C. Sawyer, sales manager, Pacific Power & Light Company, Portland, who outlined the purpose of the meeting as being to receive progress reports from committees and, through discussion, to point the way for further studies which should form the basis for final reports. He read a letter from D. C. Green, vice-president and general manager, Utah Power & Light Company, Salt Lake, president of the association, regretting his inability to be present.

The first committee to be heard from was the domestic range committee, for which R. B. McElroy, assistant sales manager, The Washington Water Power Company, Spokane, reported that activities had been confined to co-operation with the program of the national committee in gathering complete descriptions of typical successful range campaigns by Northwest companies for inclusion in the report of that committee.

Discussion opened by V. H. Moon, appliance sales superintendent, Pacific Power & Light Company, Portland, centered around the cost of installation as one of the elements of resistance to the sale of ranges, and reports were heard from practically all companies present as to the cost of installation in their territories, showing that there was considerable variation. Suggestion was made that contact with the Northwest Association of Electrical Inspectors might be productive of much good in working out a more or less uniform standard of installation, which, keeping in mind the necessity of safety, should be made as low as possible.

In further connection with the discussion on ranges, the allied subject of water heating was brought up by R. W. Clark, sales manager central district, Puget Sound Power & Light Company, Seattle, stressing the necessity for careful analysis of individual conditions to be met in each water-heater sale so that the heater sold would give satisfaction. After some discussion of flat rate and metered water heating generally, Lewis A. Lewis, sales manager, The Washington Water Power Company, Spokane, reported on his recent attendance at a meeting of the water heater survey committee of the P.C.E.A., stating that this committee definitely has agreed to undertake a water-heater survey in California similar to the range survey recently completed by the Northwest committee, of which he was the head.

Whether the power companies should sell refrigeration or whether it should be left to dealers was the main question raised in the discussion of this subject. Lewis A Lewis, reporting for the committee, told the results of a questionnaire sent to member companies asking for company policy and opinion on many phases of the problem. Results of this questionnaire revealed a cooling in the ardor of commercial managers principally on account of servicing troubles but partly due to low kilowatt-hour consumption and low rates in the West and to the fact that dealers seemed to be doing a reasonably good job of selling the machines, so that there was likelihood of a considerable volume of this load being placed on the company lines without active participation by the power companies. Manufacturers, it was declared, had set themselves quotas of 12,000 compressors in the territory in 1927. A difference of opinion developed as to the degree of responsibility for promoting the sale of this device that should be accepted by the power company, but it practically was agreed that the power company at least should lend moral support to the dealers, do some advertising, and keep machines on display.

Manufacturers Speak

The voice of the manufacturers was heard through E. S. Mathews, sales manager, Electro-Kold Corporation, Spokane, George Jones, of the public utilities division of the Frigidaire Corporation, Dayton, Ohio, and A. H. Jaeger, Kelvinator, Inc.—Leonard Regrigerator Company, Grand Rapids, Mich., through whom it was brought out that the West was far behind other sections of the country in receptivity to refrigeration of any kind, that the manufacturers' products were improving in excellence, and that power company support should be given to those manufacturers that made a good product and maintained adequate representation in the territory.

The afternoon session opened with a discussion of the competitive power situation in the territory, led by B. P. Bailey, district manager, Pacific Power & Light Company, Yakima, chairman of the committee. It was brought out that the national committee is gathering data for use of power salesmen in combatting competition on power costs of other forms of power, and that the Northwest committee would assist in gathering such data from this territory. W. H. McMurray, power salesman, Pacific Power & Light Company, Yakima, opened the discussion with a paper on diesel engine competition, which is the most serious form of competition in the Northwest, calling attention to the sometimes unfair tactics of the diesel salesman who disrepresented the cost of his power through neglect to include fixed charges on investment when comparing diesel power with central-station electric power. The way to meet such competition, he said, was to analyze all the conditions surrounding the customer's installation to see that he is on the right schedule, to see if the demand can be reduced, to see if a labor process can be replaced by a motor, and then make sure that the diesel salesman has indicated all the costs of the

Questionnaire Results

Reporting the results of a questionnaire covering fourteen phases of commercial cooking and heating, J. C. Planginton, sales manager, Northwestern Electric Company, Portland, chairman of that committee, drew general conclusions that the load was desirable and that the possibilities of developing the field were great. The commercial cooking and baking load is generally off peak and has a load factor of about 33⅓ per cent, it was pointed out, and while the diversity is not known it is estimated that it is high and that it will increase with saturation. Consensus of opinion was to the effect that close co-operation with the manufacturer of equipment and with hotel and restaurant supply jobbers was essential and that care should be taken not to sell equipment too light for the conditions to be met.

In reporting for the lighting committee, A. C. McMicken, general sales manager, Portland Electric Power Company, Portland, told of the lighting schools planned by this committee for Portland, Seattle and Spokane. (Electrical West, January, 1927, p. 53.)

V. H. Moon, chairman of the wiring committee, reported that his committee would co-operate with the national committee in its attempt to standardize wiring, reduce its cost, and increase the amount of wiring in the home. The probable effect of increased wiring standards on kilowatt-hour sales, through possible curtailment in number of outlets due to the attendant increased cost of the higher standards, was discussed at length.

A large and comparatively untouched field for load-building was discussed by R. W. Clark, chairman of the industrial heating committee. Attention was called to the possibilities in electric welding and in small heat-treating furnaces, core baking ovens, and similar equipment. The first step should be a survey of the field, and the committee hopes to interest member companies in making a study of the situation in their

territories. In the discussion a number of existing installations were described, and it was disclosed that the field required extremely specialized handling.

The session closed with a discussion of customer relations activities, introduced by the chairman of that committee, E. L. Crockatt, assistant to vice-president, Eastern Oregon Light & Power Company, Baker, Ore.

It was brought out in discussion that keeping a customer sold was as important as securing that customer's account in the first place, and that the commercial departments should exercise some jurisdiction in the matter of billing, credits and similar functions.

At the start of the Tuesday morning session, Berkeley Snow, Northwest editor, Electrical West, Portland, was asked to tell of the work of the Northwest Association of Electrical Inspectors as revealed in the recent convention of that association. He called attention to the commercial significance of many of the activities of that association on which the influence of the commercial thinking of the power companies should be brought to bear if the interests of the industry were to be served adequately.

The report of the merchandising committee as presented by V. H. Moon urged member companies to tie in with the national committee's program for campaigning on certain small appliances during certain months in the year so as to get the benefit of the national advertising which will be done by manufacturers; debated twelve-month selling of the larger appliances versus spasmodic campaigns; discussed used employees outside the sales department to sell merchandise; and recommended uniformity of activity throughout all districts of the same company. In the discussion many successful methods of selling appliances were disclosed, but it was pointed out that no single method could be uniformly applicable to the varying conditions faced by different companies. Important points brought out were that commercial managers wanted manufacturers to offer selling plans with their merchandise; that careful preparation was a prime requisite in a campaign; that a careful market analysis led to a more intelligent application of selling effort; and that frequently other local merchants could be induced to tie in by offering their products along with the appliance sold, as coffee with a percolator, sirup with waffle iron, and so on.

In connection with the discussion, Lewis A. Lewis presented some interesting data on a post-card survey of appliances in use in Spokane. Two thousand post cards were sent out to a cross-section of the customers over the entire city, requesting the customer to check what appliances he used. Out of the 700 replies received it was shown that the saturation point was being approached in some appliances. The cards then were classified as to the number of appliances used, excluding ranges, and an analysis of the accounts in each group was averaged to give the number of kilowatt-hours used by a single customer of the group in one year. A steady increase was noted from 252 kw-hr. per customer per year in the group using only one appliance to 552 kw-hr. in the group using six appliances. The next two groups remained about the same as to average, but a jump to 828 kw-hr. per year was noted in the group using nine appliances. These data were presented to show the value of getting appliances on the lines.

Reorganization Plan

In the interest of securing greater continuity of work in the section a plan of organization was offered in a report of the special reorganization committee presented by George C. Sawyer, chairman. It was proposed to divide the section into three bureaus, power, lighting and merchandising, with a chairman and vice-chairman for each. Committees under these bureaus might change from year to year as the problems in the territory changed. Bureau chairmen, with the section chairman, would constitute the section executive committee. Vice-chairmen of the bureaus and the vice-chairman of the section would be appointed at each year's convention with the idea that they would succeed to their respective chairmanships the following year. The recommendation was passed by the meeting and referred to the executive committee of the association for action.

Last on the program was the report of the street lighting committee presented by F. H. Murphy, illuminating engineer, Portland Electric Power Company, Portland, in which progress was announced in compiling for the Northwest the first year's work of a three-year program of the national committee. The first year's work is designed to show the desirability of the load from the company's standpoint, and data were presented compiled from a questionnaire sent to member companies in the Northwest to determine the characteristics of the load, load factor, rate per kilowatt-hour, return per kilowatt-year, cost of street lighting per capita, and other pertinent information. Load curves taken from one company's system were shown to indicate that the street-lighting load overlapped the daily peak from November to February and the annual peak in December, but since the load has no seasonal peak of its own and is only a small part of the system peak its effect on the system peak is a known factor and is relatively unimportant.

Accounting Section to Meet March 21.—W. L. Fitzpatrick, general auditor, Mountain States Power Company, Tacoma, chairman of the Accounting Section, announces a meeting of his section to be held at Portland, March 21, 1927, in the assembly room of the Portland Gas & Coke Company, Gasco Building. The meeting will be similar in purpose to that held last year when the custom was initiated in this section. All those interested in accounting problems are invited to attend. Papers will be presented by the different committees and general discussion by all those present will be invited.

A. I. E. E.

Vancouver Section regular meeting Tuesday, April 5. Speaker, M. L. Wade; subject, "Hydroelectric Development of the East Kootenay Power Company."

San Francisco Section.—New Developments in A.C. Rotating Machinery and in High-Voltage Underground Cable is to be the subject of a discussion presented by J. F. Spease of the General Electric Company at the March 18 meeting. Dinner at Marquard's Cafe at $1.10 per plate will precede the meeting which is to be held at the Engineers' Club, 57 Post Street.

Los Angeles Section is scheduled to meet April 1 at the City Club.

Fellows by Transfer.—K. B. Miller, Pasadena; T. A. Panter, Bu. Pwr. & Lt., Los Angeles.

Members Elected and Transferred.—Alfred Bachrach, G. E. Co., Los Angeles; C. S. Bennett, G. E. Co., Portland; F. L. Boissonnault, Westinghouse E. & M. Co., San Francisco; C. A. Copeland, Bu. Pwr. & Lt., Los Angeles; H. H. Cox, Bu. Pwr. & Lt., Los Angeles; S. E. Dunn, Clapp & LaMorse, San Francisco; L. R. Elder, G. E. Co., Portland; C. P. Garman, Bu. Pwr. & Lt., Los Angeles; C. H. George, Puget Sound Pwr. & Lt. Co., Wenatchee, Wash.; C. T. Gibbs, Holmes and Sanborn, Los Angeles; W. F. Grimes, Westinghouse E. & M. Co., Los Angeles; G. H. Hagar, Grt. Western Pwr. Co., San Francisco; C. J. Hawkes, Elec. Storage Batt. Co., Seattle; G. R. Henninger, Electrical West, San Francisco; H. W. Hitchcock, So. Calif. Tel. Co., Los Angeles; F. W. Maxstadt, Calif. Institute of Technology, Pasadena; A. L. Reading, West Kootenay Pwr. & Lt. Co., Trail, B. C.; John Salberg, Westinghouse E. & M. Co., Salt Lake; W. M. Shepard, The Calif. Oregon Pwr. Co., Medford; W. C. Smith, G. E. Co., San Francisco; E. R. Stauffacher, So. Calif. Ed. Co., Los Angeles.

Associates Elected.—D. G. Anderson, Puget Sound Pwr. & Lt. Co., Chehalis, Wash.; W. G. Angermann, Univ. of Southern Calif., Los Angeles; C. I. Anissimoff, Pasadena; A. A. Armer, Magnavox Co., Oakland; F. B. Doolittle, So. Calif. Ed. Co., Los Angeles; G. C. Farnsworth, Pub. Serv. Co. of Colo., Denver; R. D. Flatland, Robinson Sales Co., Seattle; R. K. Foulk, Home Gas & Elec. Co., Greeley, Colo.; A. W. Gigot, Granby Cons. Mining, Smelting & Pwr. Co., Anyox, B. C.; R. C. Hornberger, U. S. Bureau Reclamation, Denver; A. A. Kroneberg, So. Calif. Ed. Co., Los Angeles; W. A. Lewis, Jr., California Institute of Technology, Pasadena; W. S. McCrea, Jr., The Wash. Water Pwr. Co., Spokane; Elmer Niemoeller, The Pac. Tel. & Tel. Co., Los Angeles; L. W. Norell, Victor X-Ray Corp., San Francisco; P. J. Rempe, El Paso Elec. Co., El Paso; J. J. Rock, Grt. Western Pwr. Co., Oakland; F. H. Rooney, Columbia Steel Co., Provo, Utah; C. C. Shears, Otis Elevator Co., Los Angeles; J. M. Perlewitz, Graybar Elec. Co., Salt Lake.

Contractors, Dealers and Inspectors

California Inspectors Association Plans Convention in Oakland March 24-26

Ben C. Hill, president, California Association of Electrical Inspectors, announces that committees in charge have made all preparations for the annual convention of the association to be held in Oakland, March 24-26. The new Hotel Leamington has been selected as the site for the convention.

Features of the Program

Aside from the regular business of the association, to be transacted at the convention, a number of interesting subjects are to be discussed and speakers from many of the electrical associations are scheduled to appear on the program.

Full reports will be given of the recent code revision conferences held in the East. The work on the revision of Article 5 of the National Electrical Code will come in for especial attention.

The conventions of the Northwest Association of Electrical Inspectors, held last month in Portland, Ore., and of the Western Section of the International Association of Electrical Inspectors, held in Kansas City, Mo., in January, will be reported in considerable detail by some of those who attended them. The meetings of the Electrical Committee on the final passage of revisions in the National Electrical Code, will also be reported at that time.

Speakers representing the California Electragists, the California Electrical Bureau, the Pacific Coast Electrical Association and industrial and oil interests in electrical installation will be heard during the course of the convention.

Neon Sign to be Debated

Both sides of the Neon gas sign question will be presented during one session. The side of the manufacturer will be presented by the Electrical Products Corporation and the side of the inspectors insisting upon certain restrictions in their installation, will be upheld by the Los Angeles city electrical department.

The Foreign Legion. R. H. Manahan, Los Angeles, vice-president, California Association of Electrical Inspectors; W. J. Canada, New York, electrical field secretary, National Fire Protection Association; B. C. Hill, Oakland, president, California Association of Electrical Inspectors; M. A. DeLew, San Francisco; and C. W. Mitchell, San Francisco, secretary, California Association of Electrical Inspectors. Mr. Canada denied the rumor that he broke his arm driving home a point at the last meeting he attended.

Ralph Wiley, chief of the department of electricity, San Francisco, will be one of the feature speakers, giving a talk upon radio installation regulation.

Questions and Answers on Code

Half a day will be devoted to questions and answers on the code, according to Mr. Hill, who feels that this type of discussion is extremely valuable in bringing about uniform interpretation of the national code and eliminating necessity of multiplicity of local regulations.

Entertainment at the convention is to be in charge of C. D. Slaughter, of Allied Industries, Inc., San Francisco. Manufacturers of electrical materials have been urged to place exhibits of their materials in a number of vacant stores on the ground floor of the Leamington Hotel, making arrangements for such exhibits with the hotel management.

Los Angeles Association Names Estimating Officers

Officers for 1927 were chosen by the estimating section of the Los Angeles Electrical Contractors and Dealers Association at one of the largest meetings of the section, held recently. Mr. Hyde of the J. A. Newton Electric Company, Glendale, was named president; Mr. Hardy of the English Electric Company, Los Angeles, vice-president; J. R. Wilson, Quality Electric Works, Los Angeles, secretary, and Mr. Chandler of B. L. Perry, Inc., of Los Angeles, treasurer. The executive board consists of Messrs. Fish, Foulkes Electric Company; Chandler, B. L. Perry, Inc.; Burdick, Newbery Electric Corporation, and Drake, Foulkes Electric Company.

The estimating section meets on Thursday noons at the office of the association in Los Angeles to take up problems in estimating and to study the Electragist system of estimating.

The Seattle Electrical Contractors Association, lead by a committee composed of **R. T. Evans, City Electric and Fixture Company,** chairman, **Jim Barry, Atlas Electric Company and Frank Steele, Steele & Phelps,** had charge of the program for the Electric Club of Seattle at a meeting in December. **Jack Agutter, J. J. Agutter Company,** presided. The features of the program included an address by Architect Harlan Thomas on "Architectural Observations in Europe." Jim Barry contributed some of the amusements to the program and **Fred Ewald, Johns-Manville Company,** had charge of the musical program.

Old and New Officers of Northwest Inspectors Association

The newly elected officers. T. W. Carlon, electrical inspector and fire chief, Bend, Ore., vice-president; and H. S. Jenkins, chief electrical inspector, Bellingham, Wash., president.

Retiring president, L. W. Going, chief electrical inspector, Portland; and the re-elected secretary, F. D. Weber, electrical engineer, Oregon Insurance Rating Bureau, Portland.

C. B. Gleason, chief electrical inspector, Tacoma, headed the nominating committee; J. H. Sroufe, of Jaggar-Sroufe, contractors, Portland, engineered the banquet.

"Among Those Present at Northwest Meeting Were—"

Many members from the smaller cities and towns were present, among whom were W. E. Ringold, electrical inspector and fire chief, Pendleton, Ore., and E. S. Colby, of the Apple City Electric Company, contractors, Hood River, Ore.

Seattle's voice was heard frequently and to good effect through its delegates, among whom were A. Nicholson, chief electrical inspector, and H. A. Patton, electrical inspector, Washington Surveying and Rating Bureau.

The utility companies have taken an active part in the work and evidently enjoy it. F. H. Murphy, illuminating engineer, Portland Electric Power Company, Portland, and J. B. Fisken, consulting engineer, The Washington Water Power Company, Spokane.

The Underwriters' Laboratories, Inc., were ably represented by E. G. S. Pryor, resident engineer, Seattle, who headed the committee on standards and standardization, and R. J. Larrabee, assistant electrical engineer, San Francisco, who was elected to honorary membership.

Northern Electragists Hold Annual Boat Ride and Sacramento Meeting

Culminating in a luncheon meeting with the Electrical Contractors' Association of Sacramento, the California Electragists, Northern Division, held its annual outing and spring meeting in the form of a boat ride and noonday meeting, Feb. 17-18. At the noon meeting in Sacramento, Feb. 18, there were present 120 people, contractors, central station, jobbers' and manufacturers' representatives.

Although it had been announced that no formal program would be prepared or presented the meeting turned out to be of more than usual interest from many standpoints. Under the arrangements of the Sacramento Electragists headed by Carl Vining, acting chairman of the local association, and Louis McInnis, secretary, the committee in charge of the program arranged an attractive musical program. Maynard Cannon acted as chairman of the day introducing the various speakers and musical numbers.

Mayor Goddard of Sacramento greeted the visitors to the city and paid tribute to the electrical men of the city and especially to the new Memorial Auditorium, just being completed, which contains an extraordinary electrical installation. J. O. Tobey, president of the Sacramento Valley Electrical Development Society, was the next speaker. He also welcomed the visitors.

Clyde Chamblin, president, California Electragists, was the next speaker. He commented upon the good turnout and gave the opinion that if the lack of program had brought out so large a crowd the Electragists would take a lesson from the occasion and hereafter omit programs.

Victor Hartley, executive secretary, California Electrical Bureau, spoke for a few moments on the advertising being carried on by the Bureau to lessen sales resistance on the sale of electrical appliances and the furtherance of the Red Seal plan. Copies of the advertisements being run were offered to dealers wishing them for window display.

Courtright Tells Lamp Story

A feature of the meeting was an informal talk by H. H. Courtright, manager, Valley Electrical Supply Company, Fresno. Mr. Courtright gave a portion of the talk he has presented to the co-operating electrical contractor-dealers in his territory, dealing with lamp selling. He first showed by means of charts what the sale of larger lamps meant to the electrical dealer. How the dealer can figure lighting in simple terms of watts per square foot was next pointed out and the importance of keeping fixtures and lamps clean emphasized. He ended his talk very strongly by showing how not only the customer but the power company and dealer lose by the sale of lamps of voltage over that of the voltage on the lines upon which they are to be used.

A musical program was contributed by all branches of the electrical industry in Sacramento. The Pacific Gas and Electric Company was represented by Douglas Cadman, vocal soloist, accompanied by L. Shouse. The Great Western Power Company was represented by two soloists, A. Payne and S. Pascal, both of whom were accompanied by G. Ele at the piano. The Sacramento contractors were represented by a professional entertainer, Clay Thompson, known as the Troubadour.

After the meeting a large number of the visitors accompanied Maynard Cannon to the new Memorial Auditorium and were shown the electrical features of this well equipped combined theater and auditorium.

C. B. Kenney, vice-president and general manager, **Ne Page McKenny Company** of San Francisco and Seattle, has just returned from a trip to Portland and Seattle.

Denver Electragists at Their New Store

Two prominent Electragists of Denver, Colo., are E. A. and G. L. Scott. These boys have built up an enviable reputation in their community and recently moved into their larger quarters shown in the accompanying photograph. The name "Electragists" is prominently displayed on both windows. Eddie Scott is a member of the advisory board, Electrical League of Colorado.

Personals

R. L. Cardiff, manager, Coast Counties Gas & Electric Company, Santa Cruz, Calif., has been appointed general chairman for the annual convention of the Pacific Coast Electrical Association, to be held in Santa Cruz June 14-18. Mr. Cardiff has been a pioneer in the electric light and power industry in California since his arrival in that state in

R. L. CARDIFF

1887. He was born near Ottawa, Canada, in 1868, and obtained his grammar and high school education in that country. After his arrival in California he spent four years ranching in San Benito County and then in 1892 went to Santa Cruz to attend business college. As he tells it, "During this time I became acquainted with the officials of the Santa Cruz Electric Light & Power Company, and though the electric light and gas industry was in its infancy at that time I got interested and decided to take up this work and started in working for the company in 1892 at the munificent salary of $35 per month. Our hours at that time were from 7 a.m. to 6 p.m. and back again shooting trouble from 7 to 10 p.m. During the first few years my work was general, doing house-wiring, climbing poles and doing general line work, firing boilers, taking shift in the power house, reading gas meters and collecting, all the electric bills being on a flat rate at that time." In 1896 Mr. Cardiff was appointed superintendent of the Santa Cruz Electric Light & Power Company, retaining that position until about 1902 when the Co-operative Electric Company was started in Santa Cruz, and he joined that organization as superintendent. In 1905 John Martin merged the different electric companies in Santa Cruz, and Mr. Cardiff was made superintendent of the mergd companies. In 1912 he was appointed district manager for Santa Cruz for the Coast Counties Gas & Electric Company and shortly thereafter became manager for the entire district, which included Watsonville, Gilroy and Hollister.

Thomas Alva Edison, "electrical wizard," celebrated his eightieth birthday Feb. 11. He is the holder of more than 1,150 patents, the first having been issued to him in October, 1868, for an electric vote recorder. He invented the first practical commercial incandescent lamp Oct. 21, 1879.

Carl L. Wernicke, for twenty-two and one-half years associated with the Westinghouse Electric & Manufacturing Company, over twenty-one of which have been spent on the Pacific Coast, resigned recently. Mr. Wernicke has become associated with the same company in which **K. E. Van Kuran,** for many years manager of the Los Angeles branch of the Westinghouse company, is interested.

Harry J. Martin, of the National Carbon Company, Seattle, and former president of the Seattle Electric Club, left that city Jan. 31 for New York whence he sailed for a three months tour of Europe.

E. R. Stauffacher, superintendent of protection, Southern California Edison Company, Los Angeles, has gone to Schenectady, N. Y., where he will make a six-months stay in the engineering department of the central station division of the General Electric Company. He is to investigate the latest developments in protective equipment and also study system stability, system regulation, operating characteristics of generating equipment and other important operating problems, including the application of carrier current equipment.

E. C. Wood, superintendent of transportation, San Francisco division, Pacific Gas and Electric Company, has been re-elected chairman of the Society of Automotive Engineers of California.

P. E. Dufour, since March, 1921, connected with the transportation division of the engineering department of the California Railroad Commission, has been named valuation engineer to succeed **R. M. Vaughan,** recently resigned.

H. A. Lewis, vice-president, Electric Refrigeration Corporation, Detroit, sailed for London Jan. 15. He is expected to return about March 1.

J. E. Strickland, formerly of the commercial department, Portland Electric Power Company, Portland, has been promoted to be district manager at Oregon City, Ore., for the company, taking the place of **G. E. Sullivan,** who has been made division sales manager of the Portland division.

Charles L. Barrett, assistant secretary and director, Pacific Gas and Electric Company, San Francisco, recently returned to that city from an European tour.

Paul M. Downing, vice-president of the Pacific Gas and Electric Company, San Francisco, in charge of electrical construction and operation, has been elected chairman of the executive committee of the Stanford Alumni Association to fill the vacancy caused by the resignation of **Paul D. McKee,** formerly vice-president and general manager of the California Oregon Power Company, who has gone to New York.

John D. Gray, formerly sales manager of the International Electrical Development Corporation of San Francisco, has been named sales manager of the General Appliance Corporation of that city.

L. P. Van Atta, formerly sales engineer with the Stewart works of the Frank Adam Electric Company, San Francisco, has resigned to become associated with The Coddington Company, consulting mechanical engineers of that city.

Leonard Cahoon, manager of the Stratton-Cahoon Company of Salt Lake City, was elected president of the Engineering Council of Utah at the recent annual election of officers of that organization. Mr. Cahoon was born in Salt Lake City. He is a graduate in mining and mechanical engineering, University of Utah, 1905. Immediately after his graduation he became associated with the United States Smelting, Refining & Mining Company, with headquarters in Salt Lake City, and in that position he spent seven years in designing and construction work. He then took a position with the Chief Consolidated Mining Company, spending about a year in the designing and building of that company's hoisting works at Eureka, Utah. He has been associated also with the International Smelting Company in special designing work. He later supervised the construction of the administration building at the University of Utah. For a period of seven years he was in charge of the shops of the Galigher Machinery Company in Salt Lake City, with the title of engineer and shop superintendent. Mr. Cahoon is a member of the Utah Society of Engineers, having served on the

LEONARD CAHOON

executive committee of that organization and also as president. He is also a past president of the local section of the American Society of Mechanical Engineers, and is now a member of the executive committee of that section for 1927. He also served as a member of the executive committee of the Utah Engineering Council in 1926, and has been active for some two years on a standing committee formulating and perfecting a constitution for the present Engineering Council of Utah, which is the parent organization of the various engineering societies in Utah.

V. H. Moon, superintendent of appliance sales, Pacific Power & Light Company, Portland, has been declared grand prize winner in the West for the agency group in the "Behind the Line" contest recently conducted by the Edison Lamp Works of the General Electric Company. **L. W. Brainard,** Idaho Power Company, Boise, won first prize for the retail agency classification. The first prize for the Los Angeles district went to the Southern California Edison Company.

Harry T. Hughes, treasurer, Public Service Company of Colorado, Denver, made an extensive trip through the Pacific Coast states in December and January, visiting the larger utility companies in the territory.

Shohachi Wakao has been elected president of the Tokyo Electric Light Company of Japan to succeed the late K. Kambe.

G. E. Sullivan, for eleven years district manager at Oregon City, Ore., for the Portland Electric Power Company, Portland, has been appointed division sales manager for the Portland division of the company, a newly created position in the commercial department under **A. C. McMicken,** general sales manager. Mr. Sullivan was born in Watertown, N. Y., in 1890, and moved to Oregon City with his parents at an early age. His preparatory education was received in that city, and later at the University of Oregon, Eugene, he received a B.S. degree in 1908 and a master's degree in engineering in 1909. His service with the company, however, antedated the completion of his schooling, since as early as 1903 he carried water, during the summer vacation, on

G. E. SULLIVAN

construction jobs then being undertaken by the Portland General Electric Company, a predecessor of the present company. He continued to work on construction projects during the summer for this and allied companies until after his graduation in 1909 when he entered the engineering department of the Portland Railway, Light & Power Company, as it then was known. His aptitude for executive and commercial phases of the business led to his transfer on Dec. 1, 1915, to be district manager at Oregon City, where he remained until his recent promotion.

A. B. Day was elected executive vice-president and general manager of the Los Angeles Gas & Electric Corporation at a meeting of the board of directors Feb. 9. The promotion of Mr. Day, who was formerly vice-president, was the only change in the executive personnel. Other officers were re-elected.

L. J. Garner, formerly chief clerk of the sales department, Puget Sound Power & Light Company, Seattle, has been appointed superintendent of appliance sales for that company's central district.

George Kidd, president, British Columbia Electric Railway Company, Ltd., Vancouver, accompanied by Mrs. Kidd, recently returned from London where Mr. Kidd attended the general meeting of the stockholders of the company. **W. G. Murrin,** vice-president of the company, was made a director of the company at that meeting.

J. B. Black, formerly vice-president and general manager, Great Western Power Company, San Francisco, has gone to New York to take up his duties as vice-president of the Western Power Corporation. **A. E. Wishon,** who succeeds Mr. Black in addition to retaining his position of vice-president and general manager of the San Joaquin Light & Power Corporation, Fresno, has established his headquarters in San Francisco. He will reside in Oakland.

Walter D. Olson, lighting salesman formerly with the Pacific Gas and Electric Company's San Jose division at Redwood City, has resigned to become affiliated with the Domestic Engineering Corporation, San Francisco.

Lewis A. Lewis, commercial manager, The Washington Water Power Company, Spokane, and **J. F. Orr,** commercial manager, Idaho Power Company, Boise, attended the meeting of the water heating committee of the Commercial National Section, N.E.L.A., held recently in San Francisco.

H. C. Rice, formerly assistant merchandising manager, Southern California Edison Company, Los Angeles, has been appointed merchandising manager. **R. I. Caruthers,** formerly merchandising manager, has been transferred to the general commercial payroll pending his recovery from the injury he received last July in an automobile accident.

Edward Caldwell has resigned from the presidency of the McGraw-Hill Book Company, Inc., New York City, and will retire from active business. Mr. Caldwell has been associated with the McGraw-Hill interests for thirty-six years. He was one of the organizers of the McGraw-Hill Book Company, Inc., in 1909, and has been active in its management since its formation. Mr. Caldwell will remain on the boards of directors of the McGraw-Hill Book Company, Inc., and the McGraw-Hill Publishing Company, Inc. **Martin M. Foss,** who was associated with Mr. Caldwell in the organization of the McGraw-Hill Book Company, Inc., has been chosen to succeed Mr. Caldwell as president.

F. F. McCammon, newly elected chairman of the Electrical League of Colorado, was born in Colorado Springs in 1889. Following his graduation from Colorado College in 1916 with the degree of bachelor of science in electrical engineering, he entered the student training course of the Denver Gas & Electric Light Company and continued until the outbreak of the war, through which he served as ensign in the engineering division of the United States Navy. In July, 1919, he returned to Denver and for a year was general engineer for the Denver Gas & Electric Light Company. In 1920 he was appointed manager of the power sales division of the Public Service Company of Colorado, which had taken over the former company, and has continued in that position up to the present time. Mr. McCammon holds membership in the National Electric Light Association, the American Institute of Electrical Engineers and the Denver Chamber of Commerce. For several years he has served on the advisory board of the League.

F. F. McCAMMON

Robert H. Owen, widely known in electrical engineering circles, has been appointed in charge of technical operations of General Electric Company's broadcasting station KOA, Denver, Colo.

W. H. Yeo, Las Cruces, N. M., has been appointed state engineer for New Mexico.

Obituary

Russell Robb, senior vice-president, treasurer and director of Stone & Webster, Boston, died Feb. 15, 1927.

Anson W. Burchard, vice-chairman of the board of directors and chairman of the executive committee of the General Electric Company, and chairman of the board of directors of the International General Electric Company, died in New York City Jan. 22, 1927, at the age of 62. He had been connected with the General Electric Company since 1902.

Meetings

Coming Events

California Association of Electrical Inspectors.—Annual convention at Hotel Leamington, Oakland, Calif., March 24-26, 1927.

Association of Electragists, International.—Annual convention at Hotel Chase, St. Louis, Mo., Aug. 8, 1927.

Pacific Coast Electrical Association.—Commercial Section, Spring meeting in Chamber of Commerce Building, Los Angeles, Calif., March 9-10, 1927.

Annual Convention, Casa del Rey, Santa Cruz, Calif., June 14-18, 1927.

Engineering Section. Meeting in San Joaquin Light & Power Corporation's Building, Fresno, Calif., April 6-8, 1927.

Transportation Section. Conference in San Joaquin Light & Power Corporation Building, Fresno, Calif., March 10-11, 1927.

National Electric Light Association—Annual Convention, Atlantic City, N. J., June 4-10, 1927.

Commercial National Section. Second Group Meeting. Edgewater Beach Hotel, Chicago, March 8-11, 1927.

Northwest Electric Light and Power Association.—Meeting of Accounting Section in Gasco Building, Portland, March 21, 1927.

Annual Convention, Salt Lake City, Utah, June 21-24, 1927.

Fourth general meeting of Engineering Section, Portland, Ore., March 10-11, 1927.

Merchandising Chief Topic at Supply Jobbers' Meeting

With central-station merchandising, installment selling and the merchandising of promotional domestic appliances discussed by three speakers the open meeting of the regular quarterly convention of the Pacific Division of the National Electrical Supply Jobbers' Association at Del Monte, Calif., Jan. 29, 1927, was one of the best in the history of the organization.

S. Waldo Coleman, president of the Pacific Coast Electrical Association, stated that merchandising programs of the central stations should be established on a basis that will encourage the greatest number of retail outlets for electrical appliances. In his opinion power companies should merchandise at a profit with a policy that will allow all dealers to compete. It is the responsibility of the central station, he said, to see that its consumers are afforded the opportunity to purchase appliances as easily as possible. Whether the company sells these appliances itself, encourages others to sell them or does both depends upon local conditions.

C. W. Banta, vice-president of the Wells Fargo Nevada Bank and Union Trust Company, San Francisco, outlined the history of installment selling, pointing out some of the benefits of this practice and some of the weaknesses. The retail volume of merchandise purchased on installment contracts amounts to $6,500,000,000 annually against total retail purchases of $40,000,000,000, he stated. In making possible the purchase of labor-saving electrical appliances on term payments the industry has done much toward the improvement of the national standard of living through making necessities of devices heretofore classed as luxuries. Competition should not be allowed to encourage the extravagant use of installment purchasing. He stated that credit losses from defaulted installment contracts are only .18 per cent as against credit losses of 1 per cent in the department store trade, .35 per cent in the grocery trade and .50 per cent in the jewelry trade.

E. W. Lloyd, general contract agent, Commonwealth Edison Company, Chicago, urged the jobbers to assist the central station in the merchandising of promotional types of appliances that require pioneering sales effort. Through such co-operation, he stated, more business could be developed in the industrial, commercial and domestic fields.

The meeting was also attended by Franklin Overbaugh, general secretary of the National Electrical Supply Jobbers' Association, and Judge Dana T. Ackerly, general counsel of the association, from New York.

Officers of Electrical League of Colorado Announced

Officers of the Electrical League of Colorado for the fiscal year 1927 have been announced.

F. F. McCammon, manager power sales division, Public Service Company of Colorado, Denver, was named by the advisory board of the league chairman of that organization. E. C. Headrick, of the Headrick Electric Company, was elected secretary, and Dean D. Clark, of the Mountain States Telephone & Telegraph Company, will succeed himself as treasurer. The officers were elected unanimously.

Vice-chairmen who are to serve the Denver organization are: jobbers—J. W. Ryall, manager of the electrical department, Mine & Smelter Supply Company; manufacturers—F. H. Herzberger, office manager, Westinghouse Electric & Manufacturing Company; Contractor-dealers—W. A. J. Guscott; and utilities division—R. G. Gentry, manager public relations department, Public Service Company of Colorado. These vice-chairmen likewise serve as the chairmen of their respective divisions.

Sales Managers Hold Conference.—General merchandising problems were discussed at a two-day semi-annual conference of sales managers and assistant treasurers of the Puget Sound Power & Light Company held in Seattle recently. The meeting, which was attended by thirty representatives, was presided over by H. J. Gille, general sales manager. On the evening of the first day the Seattle district acted as host at a dinner and theater party to the visiting delegates and ladies at the Washington Hotel and Orpheum Theater.

Annual Conferences Held by Two Companies' Managers

The regular annual conference of Pacific States Electric Company managers was held Jan. 31-Feb. 2 at Del Monte, Calif. Those in attendance included: D. E. Harris, president; S. B. Anderson, vice-president and treasurer; H. R. Noack, vice-president; J. L. Busey, assistant to the president; C. W. Goodwin, Jr., assistant treasurer; F. C. Todt, San Francisco; G. A. Boring, Portland; A. J. Lutz, Seattle, and F. J. Airey, Los Angeles, district managers in those respective cities; A. H. Kahn, assistant district manager, San Francisco; H. B. Rogers, manager at Spokane; W. R. Edwards, manager at Oakland; C. H. Thrane, sales manager, Los Angeles district; C. E. Wiggin, statistician. J. A. Kahn, president, Capital Electric Company, Salt Lake City, also attended the conference.

In the golf tournament which was held D. E. Harris won the Check Seal Trophy, and G. A. Boring won the President's Trophy and the J. A. Kahn Trophy.

The Pacific Coast managers of the General Electric Company held their annual conference at Del Monte Feb. 1-3, with J. A. Cranston, commercial vice-president, presiding. A golf meet was arranged between the members of the two companies, the contest being won by the General Electric representatives.

Oregon Technical Council Elects Officers for 1927

At a recent meeting of the Oregon Technical Council the following officers were elected for the year 1927: president—A. H. T. Williams, of Blood & Williams, mechanical engineering firm of Portland, representing the A.S.M.E.; vice-president—H. H. Schoolfield, chief engineer, Pacific Power & Light Company, Portland, representing the N.E.L.A.; secretary-treasurer—E. N. Bates, grain inspector for the U. S. Department of Agriculture, Portland, representing the A.S.M.E.

San Francisco Electrical League Elects Officers.—At the recent election of the San Francisco Electrical Development League A. H. Nicoll, sales manager, Graybar Electric Company, was chosen president, and Roy N. Phelan, secretary-treasurer, McGraw-Hill Company of California, was re-elected secretary-treasurer. New directors elected were Charles R. Musladin, sales manager, Alexander & Lavenson; Don C. Ray, manager bureau of public relations, Pacific Gas and Electric Company; and Willis L. Winter, sales engineer, Westinghouse Electric & Manufacturing Company. Directors whose terms do not expire until next year include R. J. Heffner, general supervisor of employment and training, Pacific Telephone & Telegraph Company; Burrell S. Manuel, sales manager, Fobes Supply Company; and Victor Lemoge, electrical contractor.

Manufacturer & Distributor

Instruments to be Made in New San Francisco Factory

The American Paulin System, Inc., is the new name of the **Navigator Instruments, Inc.,** San Francisco, that for the last two years has had the sales rights in North and South America, China and Japan for Paulin System instruments, consisting of altimeters, pyrometers, pressure gages, monometers and precision scales of indicating and recording types. The reorganized company now has the exclusive right both to manufacture and sell in the territory named and has moved into a new 3-story factory building at First and Folsom Streets, San Francisco.

The president of the new company is **George H. Eberhard,** and **H. E. Linden** is vice-president and general manager. **The A/B Navigator** of Stockholm, Sweden, is the parent company.

Triangle Conduit Company, Inc., Brooklyn, N. Y., announces the establishment of an office in Seattle at 912 Lloyd Building, in charge of **H. H. Manny.**

Perkins Electric Equipment Company, 85 Second Street, San Francisco, has been appointed Pacific Coast representative for **National Company, Inc.,** Cambridge, Mass., manufacturers of reinforced power chokes for station protection.

Manufacture of its electric screen for killing insects was expected to be begun March 1 by the **Frost Electric Screen Company,** Spokane, Wash., in a new factory at First Avenue and Stone Street. A patented transformer which delivers a high-power static charge to the screen is a feature of the product. Success of the screen in the orchard districts of the Pacific Northwest has assured a future to the product, W. M. Frost, president, stated.

The Illinois Electric Company has announced that its branch office in Phoenix, Ariz., has removed to 313 West Jackson Street in that city. **Frank Waite** is in charge.

A. H. Peir Company, Lincoln stable arc welders, has removed to new and enlarged quarters at 1855 Industrial Street, Los Angeles.

The San Francisco offices of **The Ideal Electric & Manufacturing Company,** Mansfield, Ohio, have been removed from 611 Howard Street to Room 607 Call Building. **A. J. Myers** is district agent.

L. A. Blackburn, who handles the lines of the **Invincible Vacuum Cleaner Company** and the **Campbell Fibre Company** and the **Acme Wire Company's** insulating material, has removed his San Francisco office to 707 Call Building.

The Denver office of the **General Electric Company** has been removed from the United States National Bank Building to the Security Building.

J. H. McRoberts, formerly associated with the **Wesco Company, Inc.,** manufacturers' agents of Denver, has resigned to become secretary-treasurer of the **Globe Electric Supply Company** of that city, also manufacturers' agents.

Columbia Electric Manufacturing Company announces its incorporation and the opening of its new plant, located at 59 Columbia Square, San Francisco, specializing in the manufacture of panel boards, switch boards and electrical sheet metal work. The firm consists of three members, **E. W. Lange,** formerly associated with J. T. Stewart in the ownership of the Stewart Electrical Manufacturing Company, and **Frank Rivers** and **Ralph Grimes,** former owners of the Electrical Sheet Metal Works. Until recently all three were connected with the Frank Adam Electric Company.

Electrical Engineering Sales Company is the new name of the firm formerly known as the **Special Service Sales Company,** with offices in the Underwood Building in San Francisco and in the Delta Building in Los Angeles. There has been no change in personnel, **A. A. Barbera** being manager of the company and in charge of the Los Angeles office and **E. Parsons** being in charge of the San Francisco office.

Peerless Light Company, 663-671 West Washington Boulevard, Chicago, has appointed **Joseph H. Reiss,** formerly in charge of its San Francisco branch, as general manager with headquarters in Chicago. **A. H. Felchen** succeeds Mr. Reiss as manager of the San Francisco office, and **Joseph Devaney** is in charge at Oakland, Calif.

The United Electric Manufacturing Company, Everett, Wash., recently has opened a factory there for the manufacture of electric hot water brooders to meet the demands of chicken-raisers in that district. The plant will turn out about fifty brooders daily.

Allied Industries, Inc., San Francisco, has been appointed Pacific Coast sales representative of the **Inland Glass Company,** Chicago, and Pacific Coast distributor of **George Richards & Company,** also of that city. The Allied Company, which also represents the **Youngstown Sheet & Tube Company,** Youngstown, Ohio, has announced that that company has prepared a schedule of net prices on Buckeye conduit at various discounts particularly valuable to jobbers and a pamphlet on engineering data of much benefit to contractors.

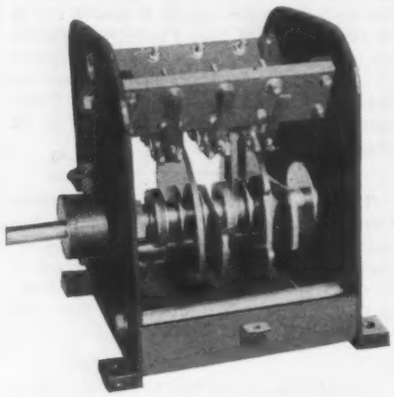
Manufacturers' Exhibit at Convention

A feature of the recent convention of the Northwest Association of Electrical Inspectors in Portland was the exhibit of the manufacturers. Twelve spaces were taken by nine firms as follows: Crouse-Hinds Company, Chicago, two; A. G. Manufacturing Company, Seattle; Metropolitan Electric Company, Seattle, two, featuring the products of the Appleton Electric Company and the Trumbull Electric Manufacturing Company; Fouts Electric Manufacturing Company, Portland; C. R. Dederick, manufacturers' agent, Portland, featuring products of the American Circular Loom Company, Columbia Metal Hose Works; Edwards & Company, Erie Malleable Iron Company, Finley Electric Porcelain Company, S. R. Fralick & Company and Quadrangle Manufacturing Company; Graybar Electric Company, Portland, featuring Square D switches; Fobes Supply Company, Portland, featuring Westinghouse equipment; Pacific States Electric Company, Portland, featuring General Electric equipment; and Frank Adam Electric Company, St. Louis, two.

New Equipment

Rotating Cam Limit Switch

A new rotating cam limit switch to be used with magnetic controllers for the automatic control of machines having such fixed sequence of operation as slowing down, stopping and reversing



has been announced by **The Electric Controller & Manufacturing Company,** Cleveland.

This switch is totally enclosed, is equipped with tapered roller bearings and is designed to carry up to six sets of contacts. Each of the cams which operate the opening and closing of the contacts is adjusted independently of the others and can be fixed at an infinite number of positions, thus giving extreme flexibility to the machine with which it is used, it is claimed.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, recently has placed on the market a new midget safety enclosed switch, and a new midget motor starting switch. The midget enclosed switch is a 2-wire, single-blade, single-fuse switch applicable to circuits of 125 volts up to 30 amp. Its over-all dimensions are only 6⅜ x 5 7/16 x 3 11/16 in. The switch consists of two principal parts, the box and the switch unit. In making an installation, the box is installed first, and then the switch unit slipped in. The new Westinghouse midget safety motor starting switch, known as Type WK-11, is the smallest motor starting switch on the market today that provides protection to the motor both while starting and running. It is designed for starting single phase a.c. motors up to ¼ hp.

Nine new types of **conduit fittings** have been added to its present line by the **Killark Electric Manufacturing Company,** 3940 Easton Avenue, St. Louis. These fittings, known as "Electrolets," are used on exposed rigid conduits such as are usually found in garages, factories, etc.

An electrically heated metal pot for melting solder, lead, babbitt, tin, etc., with a capacity of 100 lb. of lead, has been added to its line by **Harold E. Trent Company,** 259-261 North Lawrence Street, Philadelphia. The pot has a cast terminal box with an outlet in the bottom which can be arranged for BX connection or rigid metal conduit. The terminals are placed horizontally from the side walls of the casting, which facilitates connection and inspection. Quick heating, compactness of design and portability are among the advantages claimed for it by the manufacturer.

The Link-Belt Company, 910 South Michigan Avenue, Chicago, has announced that it has extended the horsepower range of Link-Belt silent chain drives, available from distributors' stocks, from its present scale of ½ to 10 hp. in practically any reduction from 1 to 1 up to 7 to 1, up to 15 hp.

The Gurgitator Washer is the name of the new washing machine being marketed by the **Conlon Corporation,** 19th Street and 52d Avenue, Chicago. Among the advantages claimed for it by the manufacturer are faster washing, simplified control of washing mechanism, simplified one-shot oiling system, heavy copper tank nickeled on inside, ease of disassembling, all moving parts completely enclosed and raised high above floor, solid construction of frame with 3-leg support, quietness and absence of vibration, gray enamel and polished copper finish.

Table Fan

The Hubbell table fan has been announced by **Harvey Hubbell, Inc.,** Bridgeport, Conn. This fan differs from the standard type of cooling fan in that the blades revolve in a horizontal instead of a vertical plane and, instead of throwing out the air, draw the air downward to the curved base of the fan, which serves as a deflector.

The fan's outstanding advantages, according to the manufacturer, are: it throws out a gentle breeze instead of a strong blast of air; its breeze is sent out horizontally in every direction; it can be placed close to the person or persons using it without fear of harmful draft; it is attractive, well made, quiet in operation and light in weight.

Recent Publications

Lighting Equipment Association Publishes Bulletin.—"Business Bulletin" is the name of the official organ of the Artistic Lighting Equipment Association, formerly the National Council Lighting Fixture Manufacturers. The paper carries the slogan of the association, "Decorate with Artistic Lighting Equipment", sets forth the purpose of the organization—"to encourage co-operation, broaden the market and promote the welfare of the lighting fixture industry"—and states that it is "devoted to the manufacture and distribution of artistic decorative lighting equipment and supplies."

Delco-Light Company, Dayton, Ohio, has prepared a pictorial booklet on "Cooling Your Drinking Water Supply" (by Frigidaire electric refrigeration). Numerous illustrations show the different uses for Frigidaire water cooling equipment.

"Babbitt Metal Data."—A booklet compiled by the **Hoyt Metal Company,** St. Louis, that should be valuable to users of babbitt metal. The information contained in the book is the result of knowledge accumulated through fifty years of successful alloying of white metals, according to the foreword.

"Tesra-Steam Heat by Electricity."—Under this caption **The Electric Steam Radiator Corporation,** 744 Harrison Street, San Francisco, explains its system of providing steam heat by electricity "without boiler or furnace."

Nickel Steel.—The International Nickel Company, 67 Wall Street, New York, has issued Pamphlet No. 9, "Physical Properties of Nickel and Nickel-Chromium Steels."

"Pole Line Hardware for Telephone Construction.—This is the self-explanatory title of a catalog issued by **Hubbard & Company,** Pittsburgh. Copies may be obtained upon request.

Fuses, Outlet Boxes and Fittings.—Catalog No. 31, a new general catalog published by the Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, lists, describes in detail and illustrates the full line of this company's products. The first section is devoted to Union renewable fuses and renewal links, Union indicating, non-renewable fuses, Gem non-indicating cartridge fuses, Gem mica top plug fuses, Union wire, cutout bases, cutout fittings, lugs, etc. The second section catalogs the full line of Union outlet boxes, bar hangers, extension rings and outlet box fittings. Gem switch boxes, including sectional, bracket and Locktite types, also are covered fully in this section.